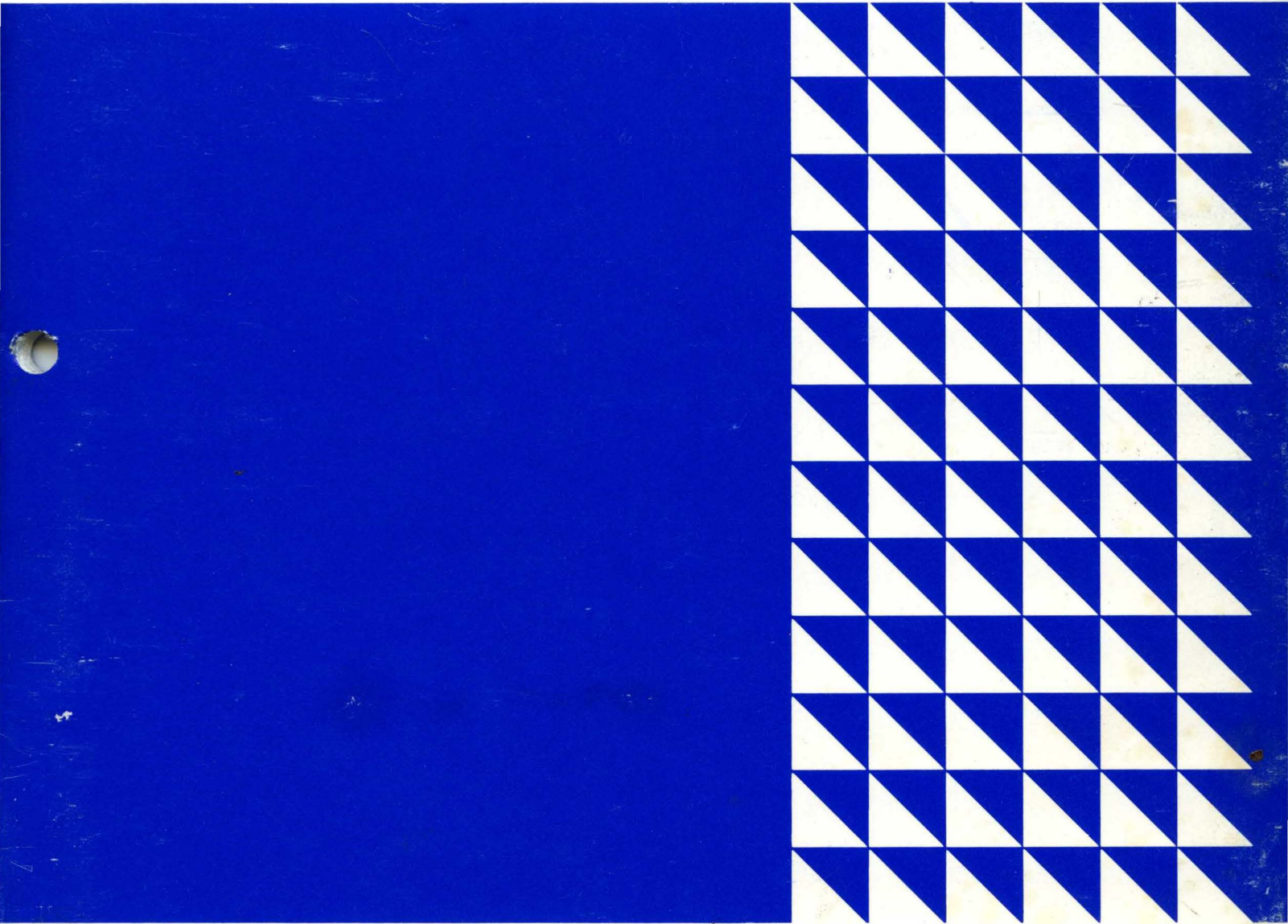**IBM**

System/3 Operation—Disk
Learner-Paced Format

Study Guide

Preface

This Study Guide presents basic data processing concepts;
describes the functions of the components of the System/3
Disk System; identifies the role of the operator in a
System/3 Disk System installation; and uses a sample
problem as a vehicle to teach typical procedures performed
by the operator in a System/3 Disk System installation.
In addition, this guide provides self-administered review
questions which will help the student determine whether
he understands the materials presented.

This guide is to be used in conjunction with the
publications and materials listed in the System/3 Disk
Learner-Paced Format Advisor's Guide (SR20-6032). The
student should refer to those additional publications and
materials whenever they are specified in this guide.

To reinforce the student's understanding of the
materials presented, the student should work with the
machines as directed in this guide.

A student with no experience in the data processing
field can use this Study Guide.

Contents

FUNDAMENTALS OF DATA PROCESSING

A person who is given a problem to solve, such as finding the sum of a list of numbers, is doing *data processing*. *Data processing* is defined as a series of planned actions and operations performed on data to achieve desired results. In general, the data processed may be any collection of facts - numbers, letters, or symbols.

Data processing has been going on ever since men began trading with each other. In the former days, the number of transactions was small and of limited variety, and the process was fairly simple. Recently, with the tremendous increase in transactions, the process has become more complex. But the elements involved in data processing have not changed. In order to accomplish the objectives of data processing, there is the requirement for INPUT, which is the data to be worked upon; STORAGE, which holds the data and the instructions that tell how the data should be processed; PROCESSING, which is the performance of arithmetical and logical operations; and OUTPUT, which shows the end-result of data processing

We can illustrate these elements by reviewing what takes place in the preparation of an invoice when it is processed manually (see Figure 1).

First, the clerk receives the customer's order. This document contains the data which will be processed, the *Input*. The clerk has previously memorized the instructions for processing the input. His brain in this case acts as *Storage*. He begins to execute the instructions, making use of a blank invoice form. He records all customer identifications and lists each item ordered. Next, he performs the required calculations (Quantity times Unit Price) for each item and records the result. In short, he does the *Processing*. After he completes the processing, he produces the *Output* - - in this case, the completed invoice.
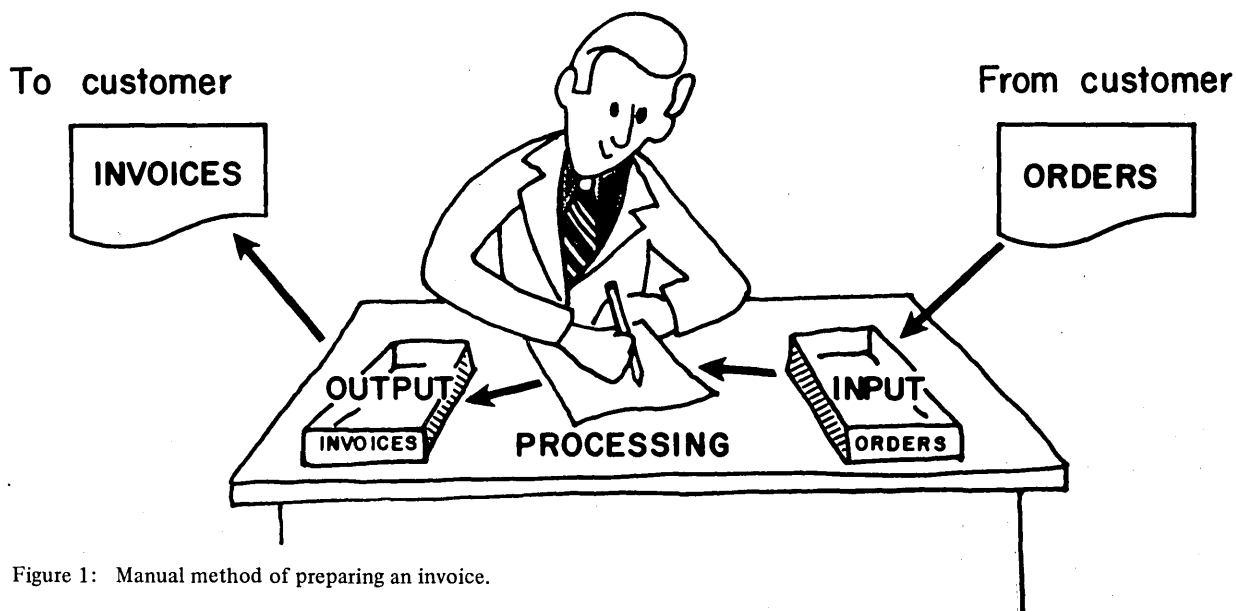
Figure 1: Manual method of preparing an invoice.

This is only one of many examples of data processing. All data processing jobs, whether they involve commercial, engineering, or even scientific data, always present the same basic elements: Input, Storage, Processing and Output. Moreover, data processing elements remain the same regardless of the volume of data or the degree of processing complexity of the data to be processed.

DATA PROCESSING SYSTEM

Although the data processing elements have not changed, the methods and aids used to accomplish the final objectives have changed. In the business world, for instance, because of the steady increase in the volume of transactions and the growing need for more reports on which to base decisions, manual methods of processing data have become too time-consuming and expensive. Consequently, man has had to search for better ways. First, punched cards and machines to process them were developed, then came computers. These developments required that processing techniques and procedures be adapted to them. The processing techniques and the machines constitute what is now known as a *data processing system.*

There are many types of data processing systems in existence today. They vary in size, complexity, cost, and application, but all of them still use the same basic elements of data processing.

COMPUTERS

This section explains what a computer is, what it does, how it processes data, how it presents the results, and what a program is.

The computer is just another *tool* used for processing data. It consists of a group of devices capable of accepting, processing, and reporting information.

Just as a clerk must be told where he will find the information for processing an invoice, the computer must be told precisely where it will find the information to be processed; also it must be told how to arrange the information, what calculations to perform, how to arrive at the final answer, and what to do with it. This set of instructions to the computer is called a *program;* the person who prepares it is called a programmer.

In general, a computer has three basic components: the Input Unit, the Processing Unit (which includes core storage), and the Output Unit. These components enable the computer to do its job.

How? First, the data to be processed by the computer is gathered. The input may be coming from customer orders, records of sales, records of items in inventory, etc. Next, the programmer prepares the program for the computer. The program tells the computer what to do

with the data. Then the user enters the program and data into the computer through an Input Unit.

To enter the program and data into the computer, they must be recorded in a form that the input unit can recognize. Figure 2 shows the recording media used in the IBM System/3 Disk System. (How the information is represented in the recording media is explained in the next section.)
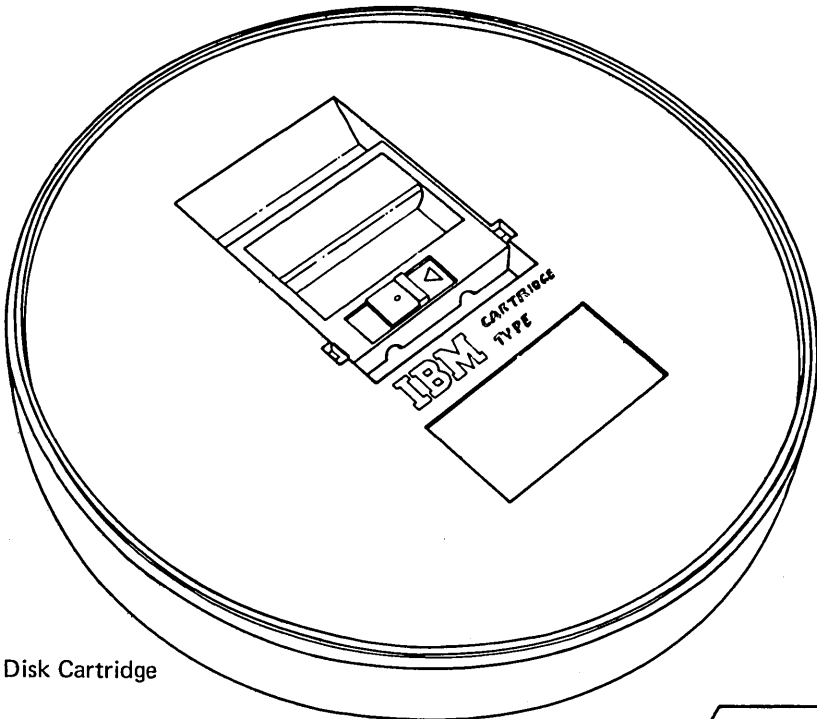
Disk Cartridge
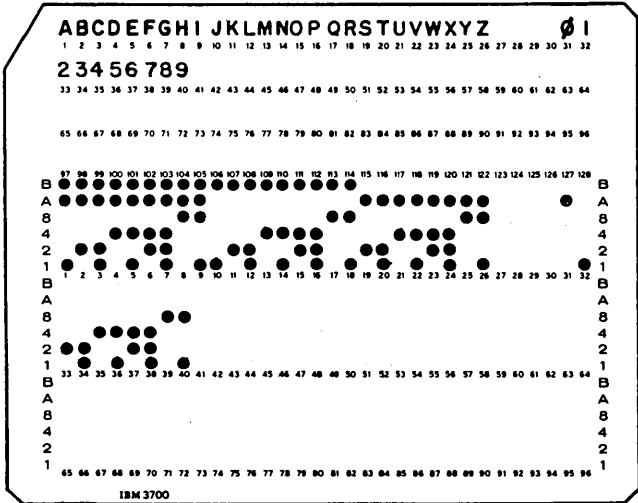
96 Column Card

Figure 2: Recording media used by the IBM System/3 Disk System.

Once the program and the data are recorded, they are then entered, the program first, into the computer via the Input Unit. An example of an input unit is the Multi-Function Card Unit (MFCU) used for reading information into the System/3. The Processing Unit acts as the director for the computer. It handles the program and the data, controls all operations of the computer, and stores the program, making data available as requested by the program.

The area in which program and data are stored is called *core storage*. It contains thousands of tiny cores, each one magnetically storing a unit of information. Because computers can process vast amounts of data in an unbelievably short time, the data must be available to the computer at a fast rate. For this reason, thousands of cores are provided to make any item available for processing as required. Obviously the size of the program also affects core storage; the bigger the program, the more core storage it will occupy. Therefore, the computer must always be provided with enough cores to hold the biggest possible program that will be run, as well as all the data the computer may be required to process.

As the data is entered through the input unit, the processing unit begins to execute the instructions in the program. After each instruction is executed, the result is produced as the output. The output may be printed and/or recorded in some form of recording media. Normally, the latter is done if the information is to be used for future reference. A printer is an example of an output unit.

Figure 3 shows the flow of events in a computer data-processing operation. Data to be processed (the input) are read by the input unit, and transmitted to the processing unit which performs the logical operations and calculations called for in the program; the result of data processing (the output) is recorded by the output unit.

INPUTS PROCESSES OUTPUTS

INPUT UNIT PROCESSING UNIT OUTPUT UNIT
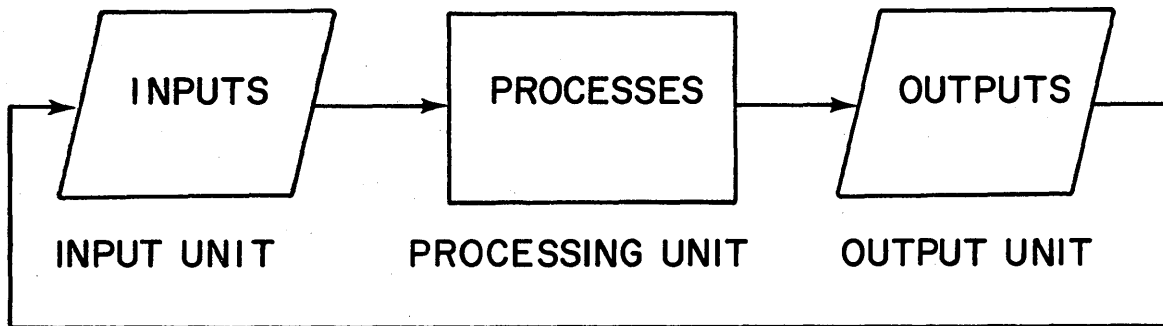
Figure 3: Flow of events in a computer data processing operation.

Please answer the following questions for Section 1. This
will help you to determine whether you understand the
major concepts covered in this section. If you have
difficulty answering any questions, go back and reread
the text. When you have answered all the questions,
compare your answers with those provided on the
following answer sheet.

1. The elements of data processing are _____ ,
   _____ , _____ , and _____ .

2. The same elements of data processing are involved
   whether the invoice is prepared by a clerk or by a
   computer. True. False.

3. A series of instructions to the computer is called
   a _____ .

4. Information is entered into the computer
   through the _____ .
   a. Input unit
   b. Processing Unit
   c. Output Unit
   d. Source Document

5. The area of the computer where programs and data
   are stored is called _____ .
   a. Card
   b. Control unit
   c. Core storage
   d. MFCU

6. Match the following:
   a. Input unit   1) MFCU _____
   b. Contains core storage   2) Printer _____
   c. Output unit   3) Processing Unit _____
   d. Performs logical and arithmetic operations

1. The elements of data processing are _Input_ ,
   Storage , _Process_ , and _Output_ .
2. The same elements of data processing are involved
   whether the invoice is prepared by a clerk or by a
   computer. True. ~~False~~
3. A series of instructions to the computer is called
   a _program_.
4. Information is entered into the computer
   through the _Input Unit_.
   a. Input Unit
   b. Processing Unit
   c. Output Unit
   d. Source Document

5. The area of the computer where programs and data
   are stored is called _Core storage_ .
   a. Card
   b. Control unit
   c. Core storage
   d. MFCU

6. Match the following:
   a. Input unit
   b. Contains core storage
   c. Output unit
   d. Performs logical and arithmetic operations.

   1) MFCU _a_
   2) Printer _c_
   3) Processing Unit _b, d_

The IBM System/3 Disk System is a high speed computer capable of solving a variety of problems. It is able to process data stored on magnetic disks. As one of the newer members of the IBM data processing family, it combines new technologies with a variety of input and output devices to make a powerful data processing tool. The System/3 is particularly well suited for business applications, such as Order Writing, Billing, Accounts Receivable, Accounts Payable, General Ledger, Inventory Control, Payroll, and Sales Analysis. Figure 4 shows the IBM System/3 and its associated devices: the Disk Storage Drive, the MFCU, the Processing Unit, the Printer, the Printer-Keyboard, the Data Entry Keyboard, the Data Recorder, and the Card Sorter.

This section describes the recording media used with the System/3, the functions of the various devices shown in Figure 4, and briefly explains how to run programs on the system. Descriptions of how to operate the various devices will be covered in later sections.
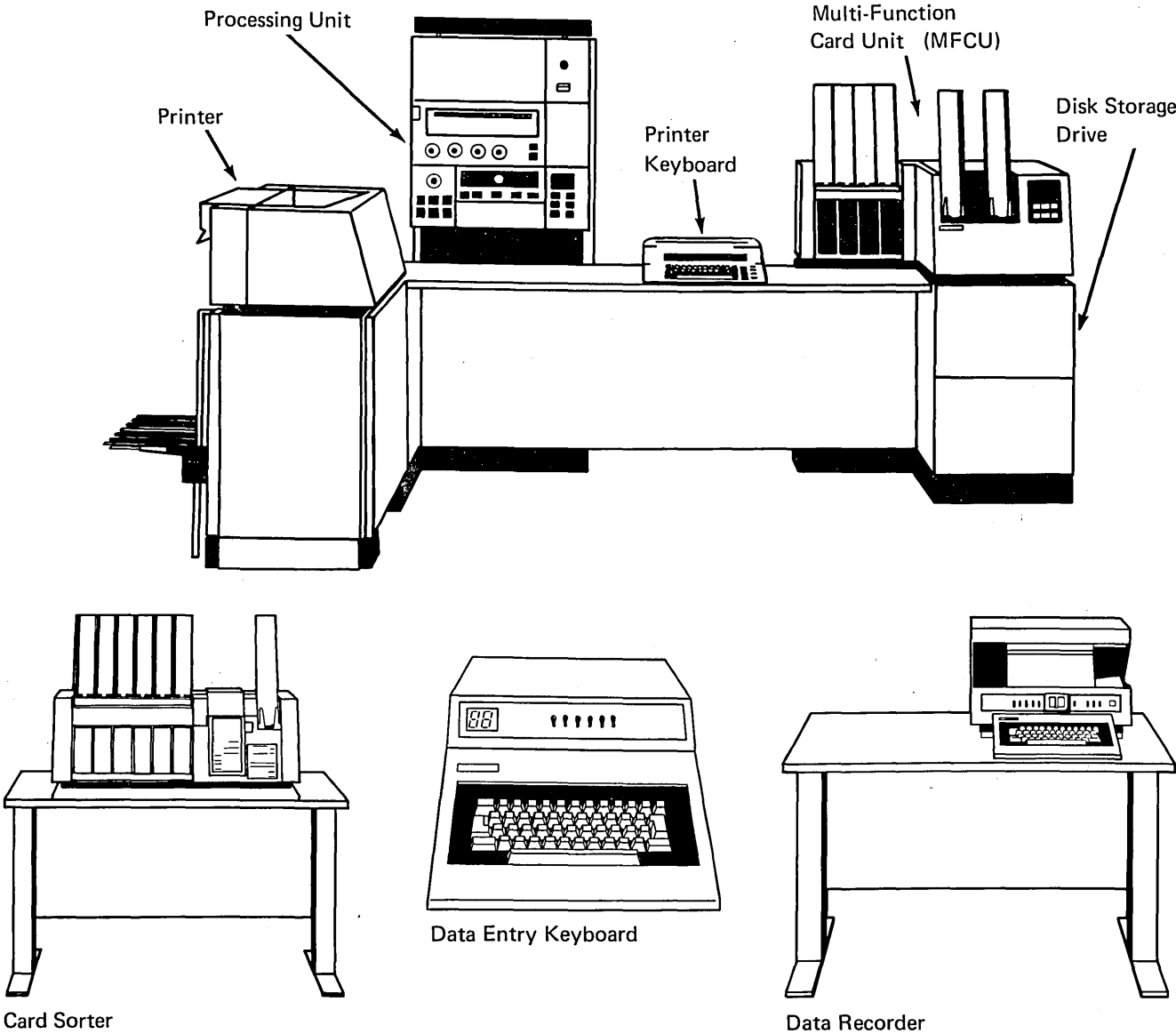
Figure 4: IBM System/3 Disk System and Associated Devices.

2-1

RECORDING MEDIA

The IBM 96-Column Card

The IBM 96-column card shown in Figure 5 is one of the recording media used in the IBM System/3 Disk System. It is a document on which information can be presented to the System/3 and on which the results of processing can be stored; in other words, an input/output medium.

Data on the card is recorded in the form of punched holes and is read by the system electronically. Data can be punched in the lower part called the *punch area,* and printed in the upper part called the *print area.* The punch area is divided into three sections called *tiers.* Each tier has 32 places or card columns where characters can be punched. In all, the card has 96 columns, each of which can contain a character. A character can be a numerical digit (0 - 9), a letter (A - Z), or a special character ($, *, %, /, etc.)
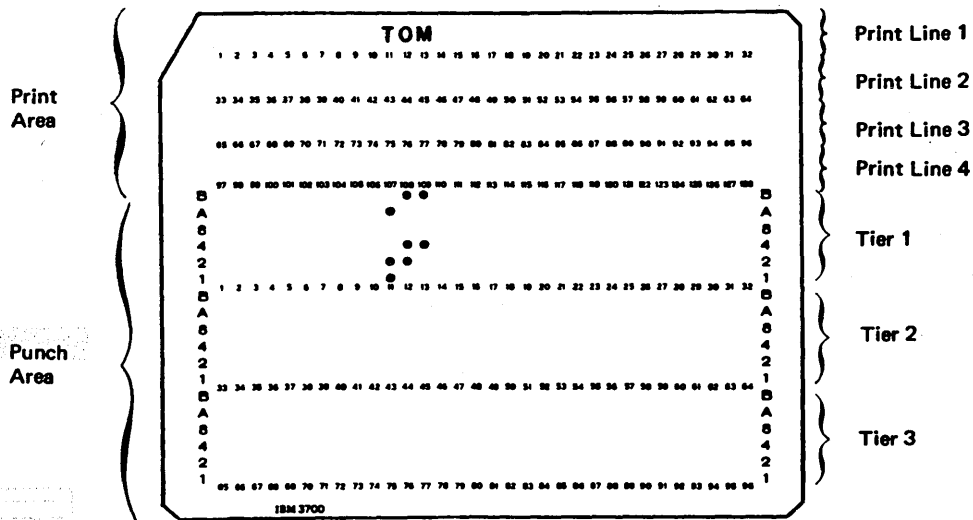
Figure 5: The IBM 96-Column Card.

There are six positions in each card column in which punches can be placed to represent a character (see Figure 6).
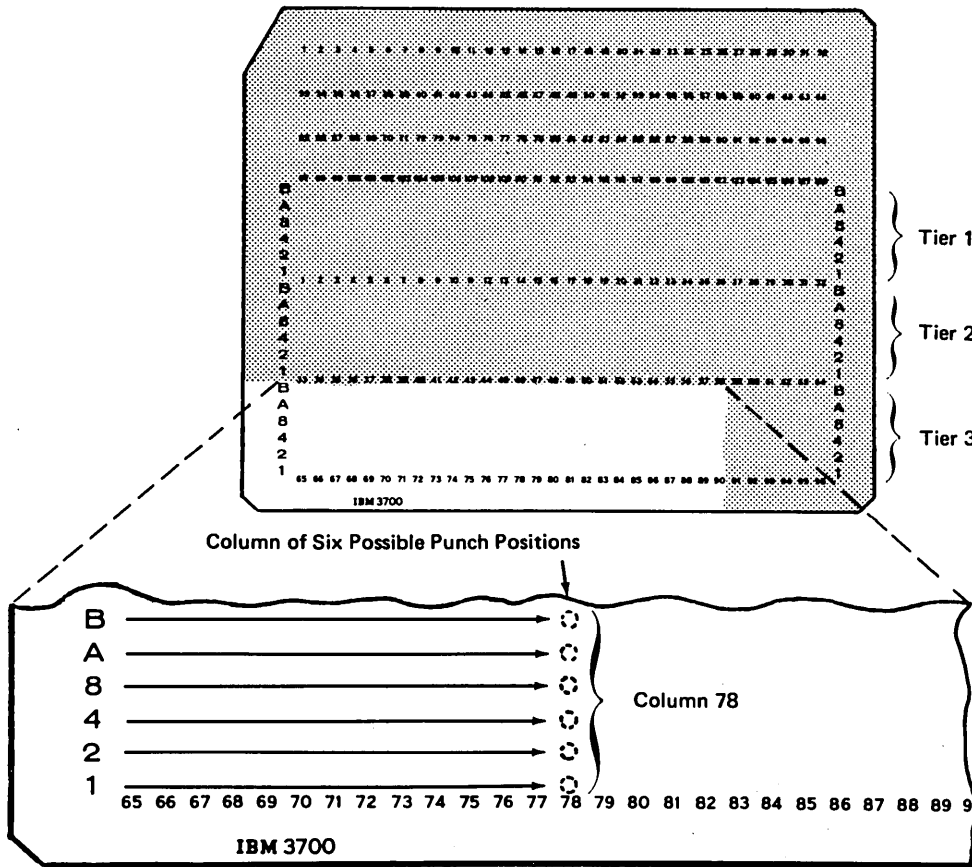
Figure 6: Column of six possible punch positions.

Sixty-four different characters can be represented by various punch combinations. Figure 7 shows the characters that can be punched. This is done by using the Data Recorder, a device with keys similar to a typewriter, which automatically punches the holes to correspond to the character that is keyed.

Magnetic Disk

The magnetic disk is another type of recording media. Like the 96-column card, it can be used to represent and store information. The information on disk is represented in the form of magnetic spots, instead of punched holes.

The characters of information are recorded on tracks in the disk surface similar to the tracks on long-playing records. Disk tracks, however, differ from tracks on long-playing record in that they are concentric, whereas the tracks on a long-playing record are one continuous spiral.

The tracks on the disk are divided into equal parts called *sectors*. Two-hundred and fifty-six characters can be stored in each sector. The disk cartridge will store 1,228,800 or 2,457,600 characters of data depending on whether there are 100 or 200 tracks on each disk surface. Each sector has its own numbered

Numeric Characters

Punch Positions			0	1	2	3	4	5	6	7	8	9
	Zone	B										
		A	A									
	Digit	8									8	8
		4					4	4	4	4		
		2			2	2			2	2		
		1		1		1		1		1		1

Alphabetic Characters

Punch Positions			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
	Zone	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B								
		A	A	A	A	A	A	A	A	A	A									A	A	A	A	A	A	A	A
	Digit	8								8	8							8	8							8	8
		4				4	4	4	4						4	4	4	4					4	4	4	4		
		2		2	2			2	2				2	2			2	2			2	2			2	2		
		1	1		1		1		1		1	1		1		1		1		1		1		1		1		1

Special Characters

Punch Positions			}	¢	.	<	(	+	|	!	$	*	)	;	¬	-	/	&	,	%	_	>	?	:	#	@	'	=	"	⌀
	Zone	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B													
		A	A	A	A	A	A	A	A									A	A	A	A	A	A	A						
	Digit	8		8	8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8	8	8	
		4				4	4	4	4			4	4	4	4					4	4	4	4			4	4	4	4	
		2		2	2					2	2	2	2		2	2		2	2			2	2	2	2			2	2	
		1			1		1			1			1		1		1		1		1		1			1		1		

Figure 7: Character set and punch combinations.

location (address) on the disk. This address allows the system to get any information it needs. For example, if an inventory file is stored on disk and the system needs data about a particular item in the inventory, it can go directly to that item without going through all the items ahead of it. Figure 8 shows a sector of a disk track containing inventory records.

Data on disk can be used again and again and changed whenever the need arises.

individual items of data are located within the record, specific areas, called *fields,* are reserved for each item of data in the record. Figure 9 shows the fields in a card and disk record. Once the computer can distinguish between records and locate specific items of data within the record, it can then perform the necessary operations on the proper data.
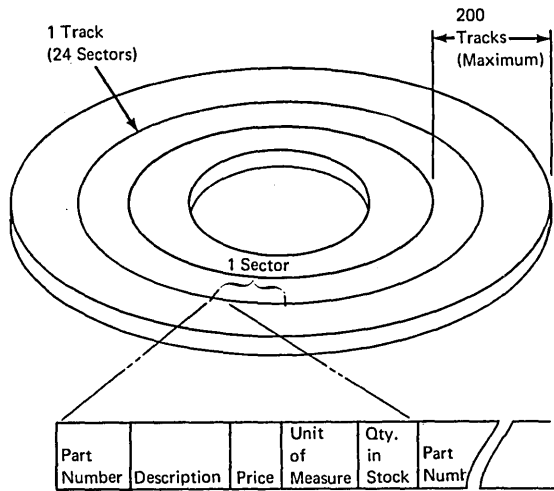
Figure 8: Inventory record in a sector on disk.
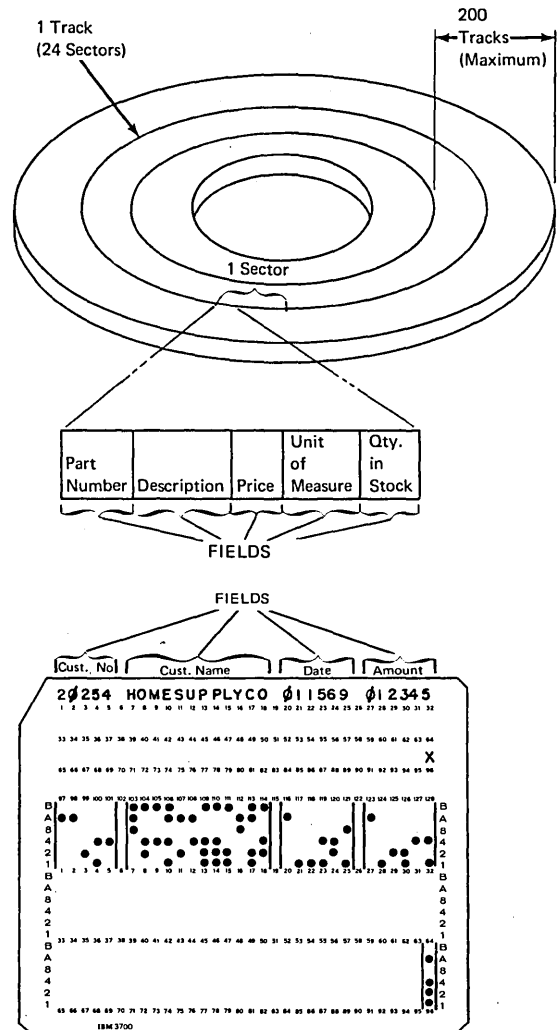
Figure 9: Records on disk and on card.

ORGANIZING DATA

Data must first be organized to be used efficiently. It is for this reason that business information is grouped into records, and records into files. The same requirements apply for organizing data in computer data processing. The computer must know the items of data that are present in a record, the records that belong to a file, and which files are to be processed. Given this information, the computer can perform the required operations on the right data.

Records and Fields

Data for processing is introduced into the computer on a per record basis. A record in computer data processing may be a card, or an area on disk which contains data about a particular topic. Figure 9 shows an Inventory Record on disk and an Invoice Summary Record on card.

Records such as those shown in Figure 9 are assigned a file code to enable the computer to identify them as belonging to a particular file. For instance, the "X" in column 96 of the card shown on Figure 9 tells the computer that the card belongs to an Invoice Summary File. Since the computer must also know where

IBM 5410 PROCESSING UNIT

The IBM 5410 Processing Unit (see Figure 4) contains the main storage and control sections of the system. The storage section holds both the program for a job and the data to be processed during the job. The control section makes the decisions: it tells the computer what to do as specified by the instructions in the program. For example, it might tell the MFCU to read a card or the printer to print a line. If the program calls for calculations - - add, subtract, multiply, or divide - - the control section carries them out.

Input, output, and processing operations can be performed at the same time. For example, while the processing unit is performing calculations for data in one card, the MFCU might read the next card, and the printer might print information from the card just processed. This overlapping of operations helps speed job performance.

Located at the front of the processing unit is the system console (Figure 10). This consists of a panel containing keys, switches, and lights which are used to manually control the system. Primary uses of this panel are for:

1. Starting and stopping the system.
2. Controlling operations of the system.
3. Entering information into the system.
4. Indicating unusual situations (such as no paper forms in the printer.)
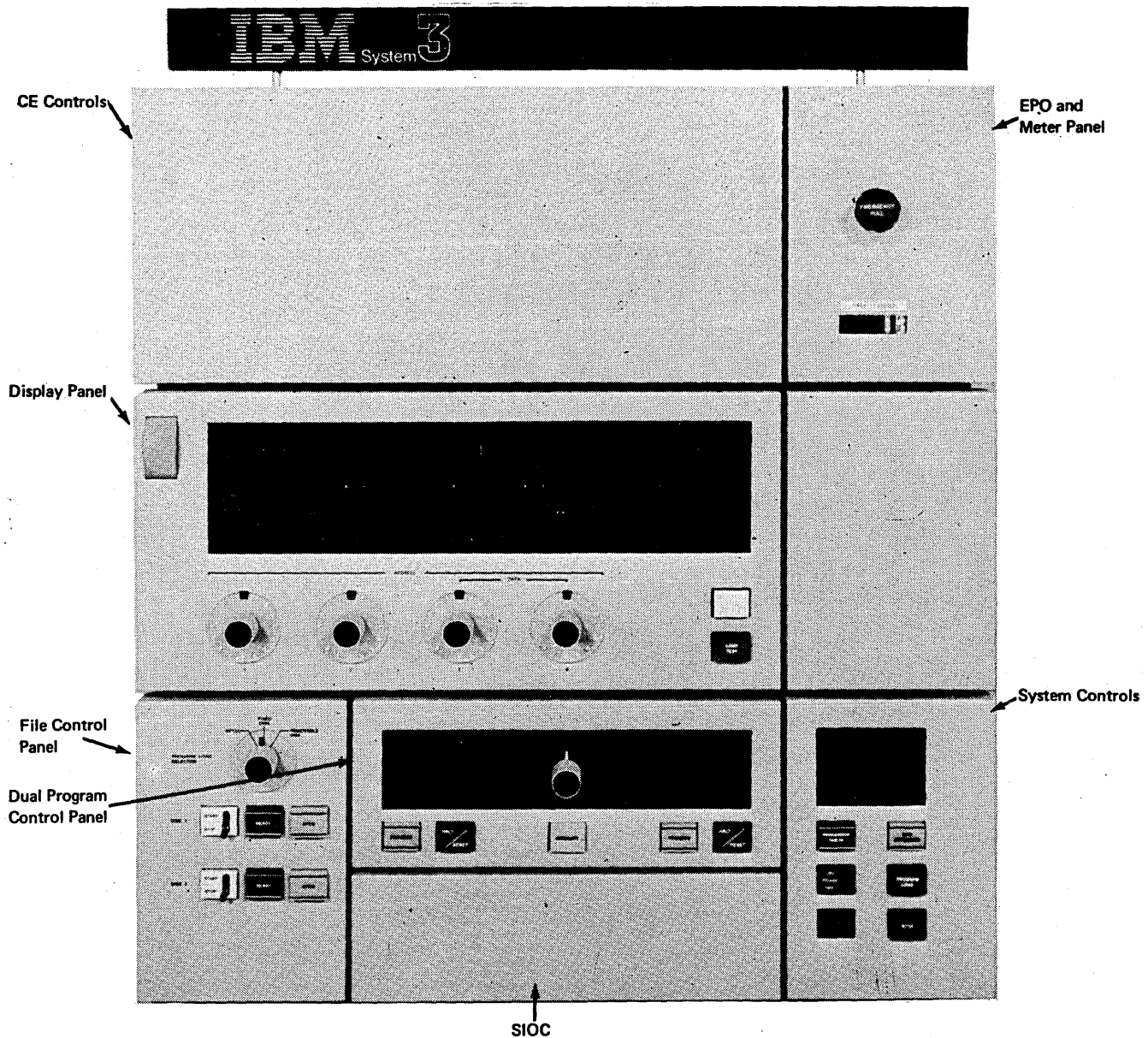
Figure 10: System Console.

The IBM 5410 Processing Unit is available in various core storage capacities: 12,288 storage positions, 16,348 storage positions, 24,576 storage positions, and 32,786 storage positions. The larger the storage capacity of the processing unit, the more program instructions and data it can store. Storage capacity has a significant effect on how fast the processing unit can do the job.

IBM 5203 PRINTER

The IBM 5203 Printer (Figure 11) provides system output in the form of printed reports. The arrangement of the printed information on the page is controlled by the program in the processing unit.

The printer uses a 48-character print set consisting of 10 numerical, 26 alphabetic, and 12 special characters. The print characters are assembled on a print chain (Figure 12).

The chain can be replaced with other chains containing different sets of characters. This permits the operator to choose a set of characters that best suits the individual printing requirement.

The printer prints in 96, 120 or 132 positions across the page depending upon the model. Horizontal spacing is ten characters to the inch; vertical spacing, six or eight lines per inch, depending on which one the operator selects. Spacing between lines and skipping to a predetermined line on a page are controlled by the program.
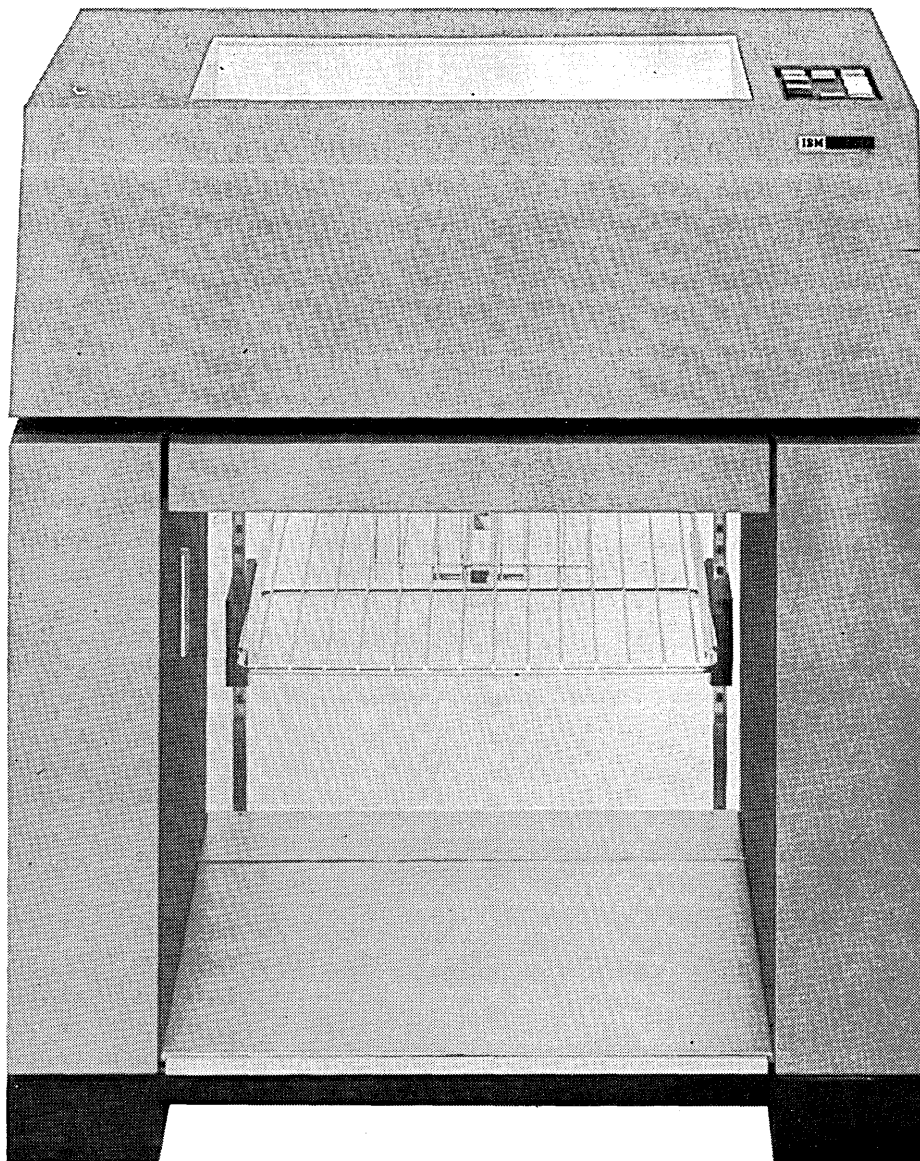
Figure 11: IBM 5203 Printer.

Figure 12: The Print Chain
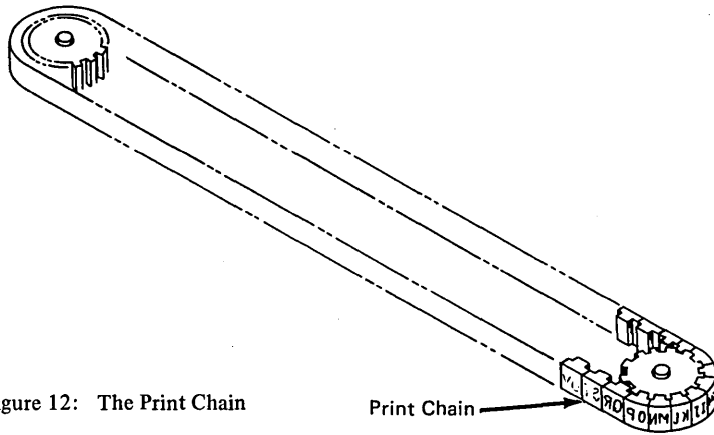
Print Chain

48 character set is
repeated five times
around the chain

IBM 5424 MULTI-FUNCTION CARD UNIT

Card reading devices place input data into the computer system. They move cards past a reading unit that converts the data on the card into electronic form which is then transmitted to the processing unit.

Card punching devices are used by the computer system to record output. The card punch automatically moves blank cards, one at a time, from the card hopper, under a punching mechanism that punches the data transmitted from the processing unit.

The IBM System/3 employs one device for both card input and output. This is the Multi-Function Card Unit (MFCU) shown in Figure 13.
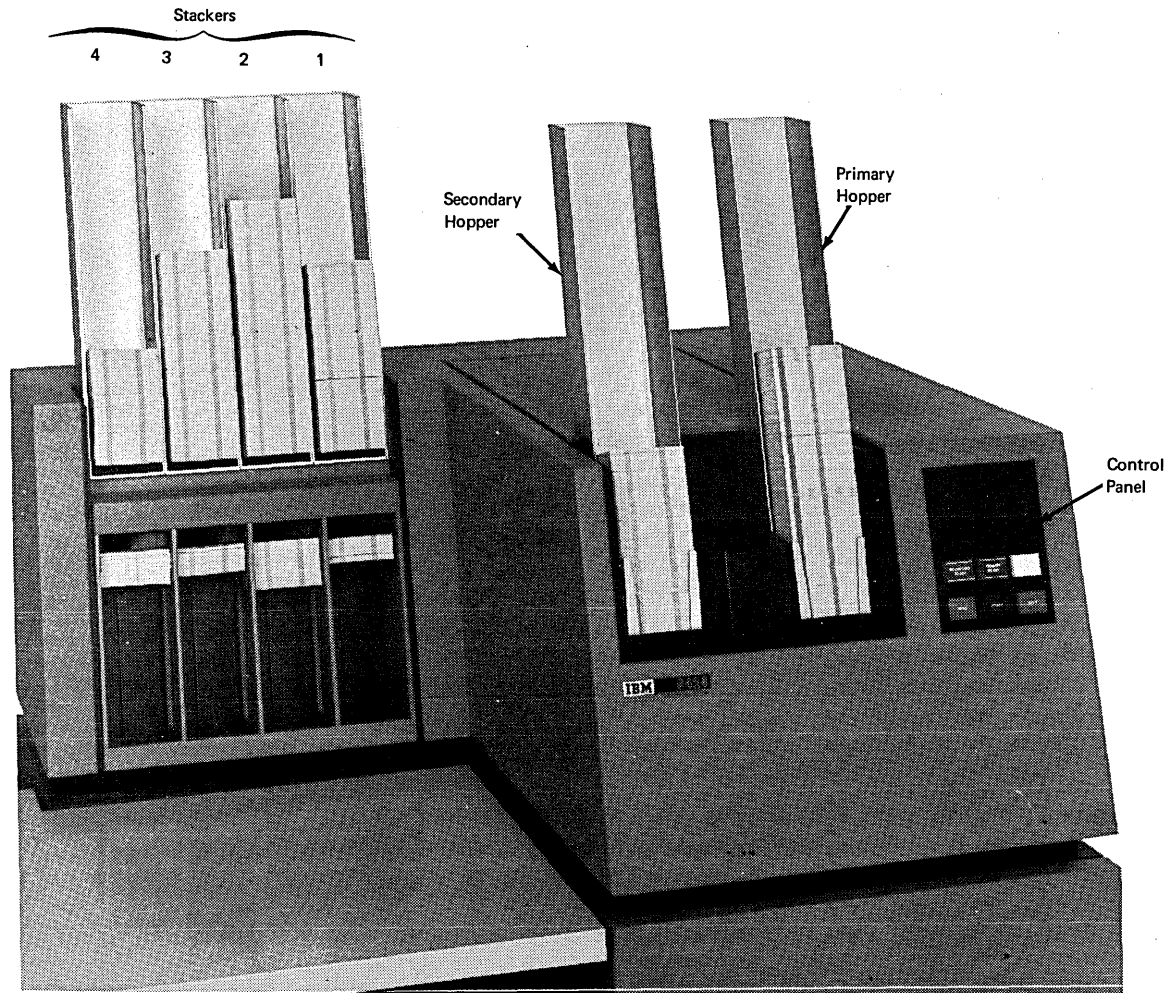
Figure 13: IBM Multi-Function Card Unit (MFCU).

The MFCU is a device that enables the system to perform card handling functions. If instructed by the computer, the MFCU can read a file of cards, punch a file of cards, or read and punch additional information into the same file of cards. The MFCU can print data on cards, and select cards to be stacked in any of the four output stackers. The MFCU can also be used to merge two decks of cards and to do all sorting functions. All these card handling functions are performed under control of a program.

The MFCU has two hoppers which operate independently. Cards placed in either hopper can be moved into a mechanism that feeds the cards through the various stations of the device: the read, the punch, the print stations, and then into the stackers (see Figure 14).

Once the card is fed from one of the hoppers, it passes through the read station. Reading is done column by column, three tiers at a time, and the data is transmitted to the processing unit. If the card is not to be read, the sensors are not activated, and the card passes through the station unread. Cards which are not to be read, for example, are blank cards.

After the card passes the read station, it enters the wait station. It then passes the punch station which uses 18 punching devices. If the card is not to be punched, the punch station is not activated, and the card passes through the station unpunched.

The card next enters the print station. The print station is capable of printing up to four lines of 32 characters each per card. If printing is not desired, the cards are ejected from the print station.

After the card leaves the print station, it is stacked in any of four stackers. Selection of the stacker is under control of the program. If no stacker is selected, cards from the primary hopper fall in the stacker closest to the print station (stacker 1), and the cards from the secondary hopper fall in the stacker farthest away from the print station (stacker 4).
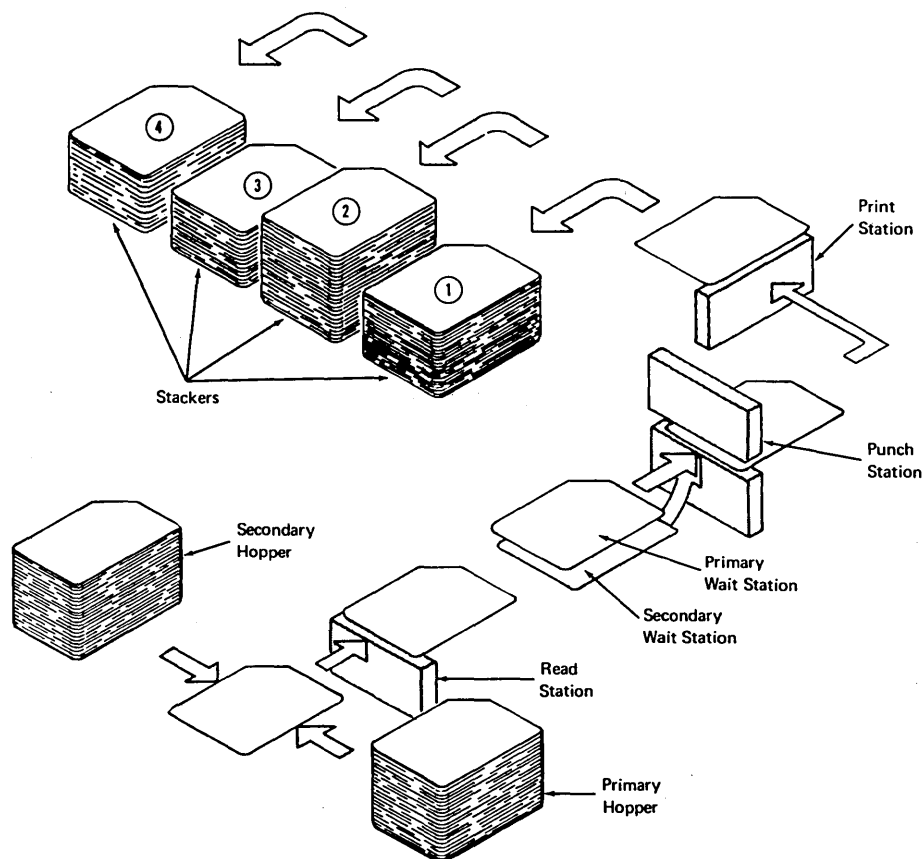
Figure 14: The MFCU Card Path.
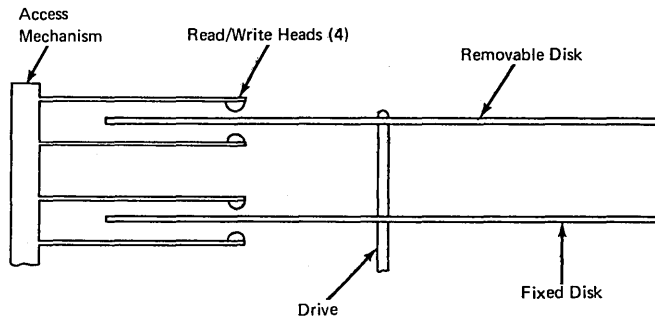
Figure 15:   Disk Drive.

IBM 5444 DISK STORAGE DRIVE

The IBM 5444 Disk Storage Drive is housed in a drawer under the MFCU. The basic unit consists of one drive, two disks, and an access mechanism (see Figure 15).

The lower disk is permanently mounted on the drive. (The drive is a vertical shaft, which rotates when the unit is turned on.) The upper disk is removable and can be replaced with other disks. It is enclosed in a cartridge which protects the disk surface and also makes the disk easy to handle.

A head attached to the access mechanism - - each of the four disk surfaces has its own head - - reads and writes information on the disk. When activated, the access mechanism moves the heads rapidly back and forth to any track across the disk surface. The heads move together: when one head is positioned at a certain track on one disk surface, the other heads are positioned at the same relative locations on the other three disk surfaces.

The IBM 5444 Disk Storage Drive can record data on 100 or 200 cylinders on each disk, depending upon the disk model. (Corresponding tracks from each surface of the same disk are called cylinders.)

IBM 5471 PRINTER - KEYBOARD

An IBM 5471 Printer - Keyboard can be installed on the system (see Figure 16). It consists of an IBM Selectric Typewriter connected to the processing unit. Using the printer - keyboard, the operator can:

1. Request information from a disk file on the Disk Storage Drive.
2. Print out requested information.
3. Enter data directly into the system.
4. Use the printer-keyboard as a second printer for low-volume output.

Figure 16:   IBM 5471 Printer-Keyboard.

The 5471 Printer - Keyboard has a 44-character print element. It can print lines up to 125 characters long at an approximate rate of 15 characters per second, and multiple copies, if desired.

IBM 5475 DATA ENTRY KEYBOARD

Users of the IBM System/3 usually will be required to transfer input data from a source document, such as a customer order, to a punched card. The process is called *data recording.*

The IBM 5475 Data Entry Keyboard (Figure 17) provides the system with on-line data recording. *On-line* means that the device is attached to the system and used to record information on the cards. *Off-line* means the data recording is done by a separate device, not part of the system. (See description on the IBM 5496 Data Recorder on the following page.) Through the keys, lights, and indicators on the keyboard, the operator can use the system for data recording and verifying. By placing the cards to be punched or verified in the MFCU hopper, and with the system under program control, he can enter the data to be punched or verified via the Data Entry Keyboard. The actual reading and punching of the cards is done by the MFCU.

On-line data recording uses a buffered input technique. This means that the entire contents of a card is keyed into system storage before any punching is done. It affords the operator the opportunity to correct errors by erasing and rekeying the data before the contents of the card are punched.

Figure 17: IBM 5475 Data Entry Keyboard.

IBM 5496 DATA RECORDER

The IBM 5496 Data Recorder device (Figure 18) is separate from other units of the System/3. It is used to transfer input data from source document to punched card form (or off-line data recording) and to verify data already punched in cards. The data recorder can print the characters that are punched in the card on the three top lines of the print area and in the same relative positions, i.e., a character punched in column 1 of the punched area is printed in print position 1 of the print area.

The data recorder has a desk, a keyboard, a hopper, a stacker, and a lower structure. The keyboard, hopper, transport and stacker are located on top of the desk. The lower structure, in addition to supporting the desk, also houses the electronics and the power supplies. All operator controls are located above desk height within easy reach of the operator.

Off-line data recording uses a buffered input technique similar to that of the data entry keyboard. However, the entire contents of the card is stored in the storage unit of the data recorder, instead of in the core storage unit of the processing unit, before any punching is done. This also affords the operator the opportunity to correct errors by erasing and rekeying the data before the contents of the card is punched.
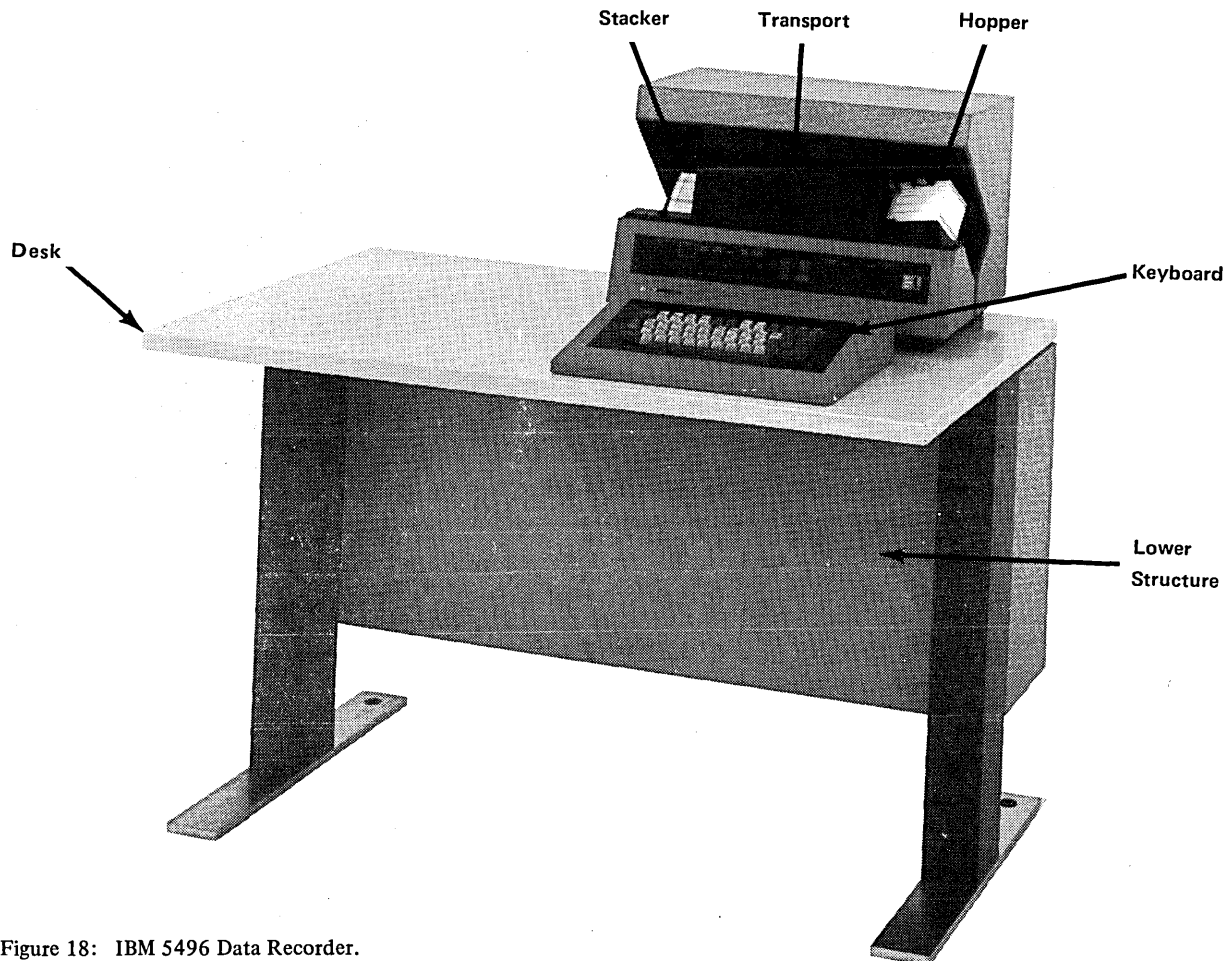
Figure 18: IBM 5496 Data Recorder.

IBM 5486 CARD SORTER

The Card Sorter in Figure 19 is an off-line device used to arrange cards into a desired sequence, either numerically, alphabetically, or alphamerically (mixed alphabetic and numerical characters).

The card sorter has a hopper, a read station, a transport mechanism, six pockets (or stackers) and an operator console.

The card sorter is normally used in installations where there is extensive demand to sort cards prior to running a job. The sorter does the sorting while the system is running other jobs. More information on the card sorter is given later in this text.
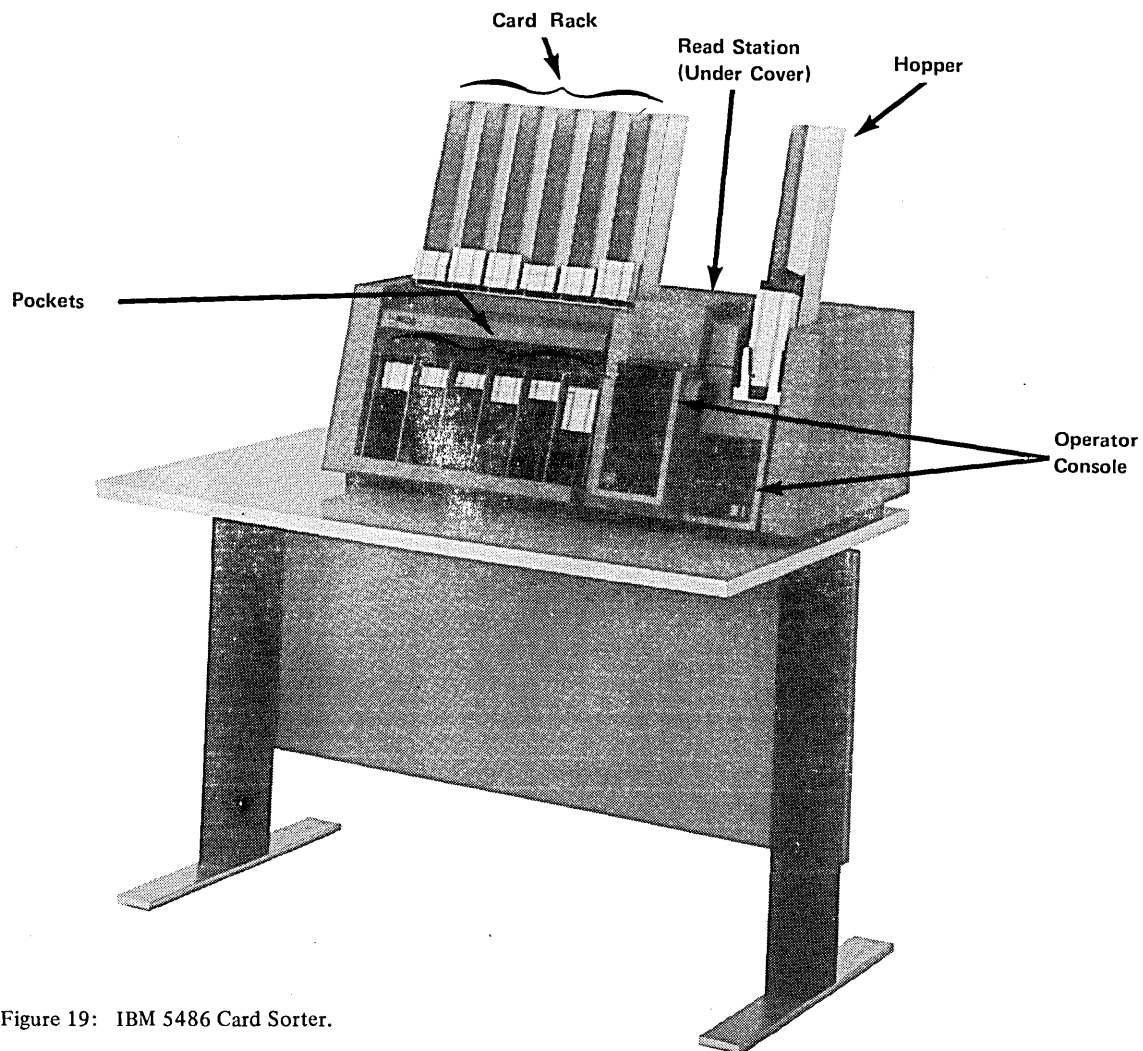
Figure 19: IBM 5486 Card Sorter.

RUNNING PROGRAMS ON
THE SYSTEM/3 DISK SYSTEM

The loading and running of System/3 Disk System programs is done under control of a group of programs available from IBM, called the *disk system management.* Disk system management is housed on the fixed disk (F1) or the removable disk (R1) only. Resident on either F1 or R1, the disk system management is normally referred to as the resident system.

Operation Control Langauage (OCL) statements are the means by which the programmer instructs the disk system management to run programs. The programmer writes a set of OCL statements for each program he wants the system to run. These statements can be supplied to disk system management in either of two ways: (1) by punching the statements into cards which are read into the system by the MFCU, or (2) by using the printer-keyboard to manually key the statements into the system.

After disk system management has read a set of OCL statements for a program, it runs the program. When the program ends, disk system management reads the set of OCL statements for the next program, then runs that program. This procedure is repeated until all OCL statements within a job stream have been read and their corresponding programs run. See Figure 20.
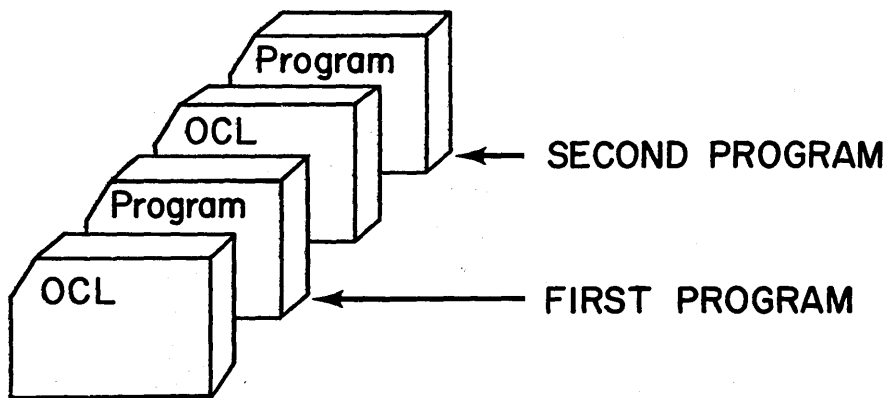
Figure 20: The Job Stream.

Please answer the following questions for Section 2.
This will help you to determine whether you understand
the major concepts covered in this section. If you have
difficulty answering any questions, go back and reread
the text. When you have answered all the questions,
compare your answers with those provided on the
following answer sheet.

2Ø254 HOMESUPPLYCO Ø11569 Ø12345
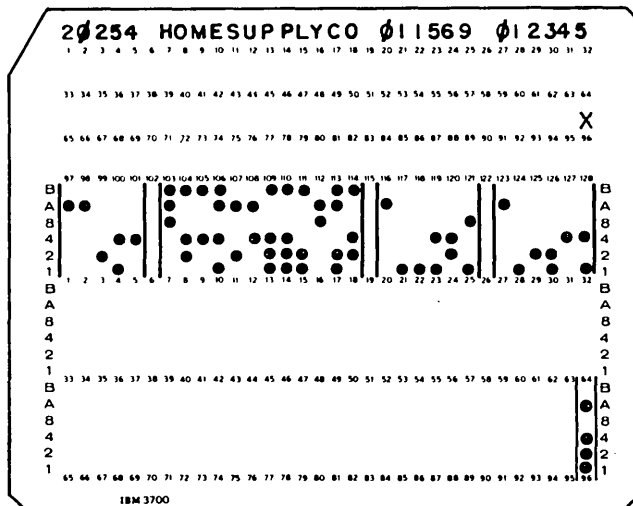
The above card was punched on a Data Recorder.

1. The computer can read the printing on the print
   area on the card. True. False.

2. Card column 96 contains the card code. What
   is the card code? _____ .
   In what position does it appear? _____ .

3. A five-digit customer number immediately
   precedes the customer name field. It appears
   in card columns _____ through _____ .
   on all cards having the same card code.

4. The card code is printed on the third line of
   the print area. In which tier is it punched?
   Tier _____ .

5. The IBM System/3 Disk System components are:
   _____ , _____ , _____ ,
   _____ , _____ , _____ ,
   _____ , and _____ .

6. The IBM 5410 Processing Unit contains _____ .

   a. main storage
   b. control unit
   c. arithmetic capability
   d. all of the above

7. The MFCU can _____ .

   a. read a file of cards.
   b. punch a file of cards.
   c. read and punch additional information on
      the same file of cards.
   d. print data on cards.
   e. stacker select cards.
   f. merge two decks of cards.
   g. do all sorting functions
   h. do all of the above.

8. It is the _____ that determines the
   operations to be performed by the MFCU, the
   printer, the disk unit, and all other devices
   attached to the system.

9. Match the following:
   _____(1) Off-line sorting
   _____(2) Enter data directly into the system
   _____(3) On-line data recording
   _____(4) Off-line data recording
   a. Data Entry Keyboard
   b. Data Recorder
   c. Card Sorter
   d. Printer - Keyboard

10. Of the following devices, which may be used
    only as an output device? _____ .
    a. MFCU
    b. Printer
    c. Disk Unit

11. Which of the following kinds of storage devices
    is physically located in the processing unit? _____
    a. 96-column card
    b. core storage
    c. magnetic disk

12. Cards that have been read by the MFCU fall into
    one of four _____ .
    a. Hoppers
    b. Bins
    c. Receptors
    d. Stackers

13. The printer can be manually controlled to print
    either _____ or _____ lines per inch.
    a. 7 or 9
    b. 6 or 8
    c. 5 or 7
    d. 4 or 6
    e. any of the above
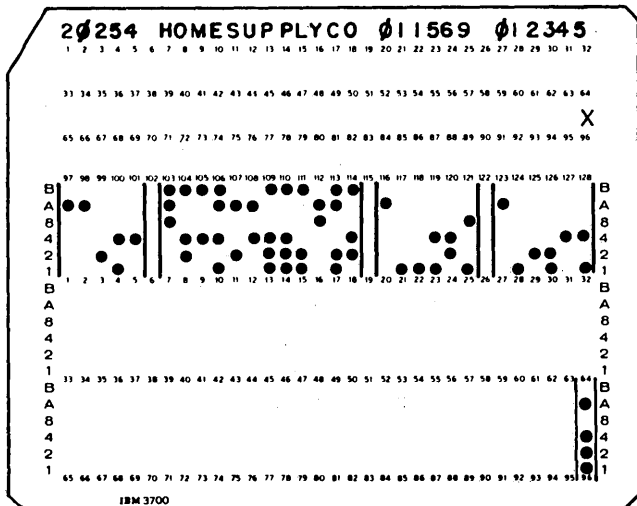
1. The computer can read the printing on the print area on the card. ~~True~~ False.

2. Card column 96 contains the card code. What is the card code?____x.
   In what position does it appear?___96.

3. A five-digit customer number immediately precedes the customer name field. It appears in card columns _1_ through _5_ on all cards having the same card code.

4. The card code is printed on the third line of the print area. In which tier is it punched? Tier _3_.

5. The IBM System/3 Disk System components are:
   MFCU , _Processing Unit_ , _Printer_ ;
   Disk Unit , _Printer Keyboard_ , _Data Entry Keyboard_,
   Data Recorder , and _Card Sorter_ .

6. The IBM 5410 Processing Unit contains ___d_.
   a. main storage
   b. control unit
   c. arithmetic capability
   d. all of the above

7. The MFCU can ___h___ .
   a. read a file of cards
   b. punch a file of cards
   c. read and punch additional information on the same file of cards
   d. print data on cards
   e. stacker select cards
   f. merge two decks of cards
   g. do all sorting functions
   h. do all of the above

8. It is the___ _program_ ___that determines the operations to be performed by the MFCU, the printer, the disk unit, and all other devices attached to the system.

9. Match the following:
   _c_ (1) Off-line sorting
   _d_ (2) Enter data directly into the system
   _a_ (3) On-line data recording
   _b_ (4) Off-line data recording
   a. Data Entry Keyboard
   b. Data Recorder
   c. Card Sorter
   d. Printer-Keyboard

10. Of the following devices, which may be used only as an output device? __b__
    a. MFCU
    b. Printer
    c. Disk Unit

11. Which of the following kinds of storage devices is physically located in the processing unit? __b__
    a. 96-column card
    b. core storage
    c. magnetic disk

12. Cards that have been read by the MFCU fall into one of four _d_ .
    a. Hoppers
    b. Bins
    c. Receptors
    d. Stackers

13. The printer can be manually controlled to print either __6__ or __8__ lines per inch.
    a. 7 or 9
    b. 6 or 8
    c. 5 or 7
    d. 4 or 6
    e. any of the above

The System/3 computer operator works in the same room as the computer. His job is to operate the System/3. His duties include everything from turning on the machine to monitoring the various jobs to produce the outputs. He is not concerned with the mathematics of the problem or the mathematics of computer design - tasks performed by other personnel - just as the typist is not concerned with the cogs and levers of her typewriter. The operator's approach to the computer is that it is his main *tool* for accomplishing the jobs to be done.

You, as the operator of the System/3, are expected to perform a number of different tasks. These are listed below. For the present, do not concern yourself with determining what steps each task entails; this will be covered later in this Study Guide.

Operating all system components.
Compiling and executing RPG II programs.
Identifying system or program halts and performing restart procedures.
Running and terminating jobs.
Running card and disk utility programs.
Mounting and dismounting a disk cartridge on the disk storage drive.
Loading and aligning paper forms on the printer.
Clearing card jams on the MFCU and card sorter.
Sorting cards using the card sorter and the MFCU.
Removing and replacing the chip box on the MFCU.
Changing the print ribbon on the printer, MFCU, and the printer-keyboard.
Changing the print chain cartridge on the printer.
Removing and replacing the type ball on the printer-keyboard.

These basic tasks are easily learned. After you have performed them once or twice, you will find you can perform them again without much difficulty.

There are other tasks which you as an operator are expected to perform. These tasks are important inasmuch as they facilitate the work and save valuable time which would otherwise be lost if the installation were poorly controlled. These tasks include:

1. Keeping the equipment area neat and orderly. In a cluttered environment, cards and other important documents can be lost or easily misplaced.
2. Maintaining program decks, card files, and disk cartridges in the order set up by the system analyst or programmer.

As defined earlier, a record is a card or an area on disk which contains data about a particular topic. When related records are stored in cards and grouped together, you have a file. When related records are stored on disk, you have a disk file (more than one file can be stored on disk). In data processing, files are usually maintained for records that are accessed and used repetitively, such as the Customer Name and Address File and the Inventory File. These files are used everytime that invoices are prepared. Similarly, programs that are used over and over again are stored in card decks and maintained in files.

The system analyst determines the most efficient way to arrange program decks, card files, and disk cartridges for easy access. He may sequence them according to frequency of usage or by application. It is the operator's duty upon completing the job to return all card decks and/or disk cartridges to their original places in file.

3. Notifying the programmer of program malfunction and the supervisor of equipment malfunction. In case of program or equipment malfunction, the operator is responsible only to the extent of informing the proper person of such malfunction.

To operate the computer system, the operator must be knowledgeable in these two areas:

1. The mechanical details of each unit. The operator must know, for example, how to load forms on the printer and how to mount disk cartridges into the disk unit.
2. The particular program being run on the computer. The Run Book, supplied the operator, gives information about each program and what the operator must do to run the program. (A more thorough description of the Run Book appears later in this section.) All user-written and IBM-supplied programs have certain required common functions, for example:

Initiation of input/output operations
Input/output device error-detection and recovery
Program loading
Communication between the program and the operator

To save the System/3 programmer added work, IBM supplies a series of programs, which together are called the *control program*. This control program is among

the group of programs that make-up the resident system (disk system management housed on disk). When loaded into the system it enables the system to perform the common required functions. The System/3 operator must know which disk or disk cartridge contains the resident system.

THE JOB SCHEDULE SHEET

There are two other tools with which the operator works the Job Schedule Sheet and the Run Book. The Job Schedule Sheet tells him what jobs to run, and in what sequence, during a given period of time. The operations manager or data processing supervisor, in charge of the over-all functioning of the installation, assigns priorities to jobs and prepares the Job Schedule Sheet. Besides containing a list of jobs to be run, the Job Schedule Sheet may also contain special information - for example, that a piece of equipment has been scheduled for preventive maintenance.

The layout of the Job Schedule Sheet varies from installation to installation. Figure 21 illustrates a typical Job Schedule Sheet.

Most of the column headings in the Job Schedule Sheet are self-explanatory. The job number and job name, or description entries briefly identify the jobs to be run.

A more complete description of the job will be found in the Run Book. The first column of the Job Schedule Sheet indicates the sequence in which each job is to be run. The last column is initialed by the operator upon successful completion of the indicated job.

THE RUN BOOK

The Run Book provides the operator with specific information furnished by the programmer regarding each program. The book instructs the operator when a job is to be run, which program to use, and how to proceed with the processing operation. Included are messages from the programmer describing errors that could occur because of incorrect input data or operational procedures, and the corrective actions he should take when the error occurs. The Run Book also specifies which printer form to use, where the input data is to be loaded from, and where to distribute the printer output.

The specific information about each program is contained in the Program Run Sheet (see Figure 22-0). The Program Run Sheet is divided into six sections, illustrated in Figures 22-1 through 22-6. Examine the Program Run Sheet (both front and back), line by line, to be sure you understand the instructions normally provided for the operator.

SCHEDULE

Date __6-2-70__

SEQUENCE	JOB NO.	JOB NAME OR DESCRIPTION	RETURN TO	OPERATOR INITIALS
1	21A	Order Writing	M.G.Marking	
2	22A	Invoicing	J.Schwartz	
3	21B	A/R Summary	J.Howard	

Figure 21: The Job Schedule Sheet.

Application __*Order Writing*_____ Date __*7-6-70*____

Program Name __*ORDER 1*_____ Number __*∅∅1*____ Programmer __*A. Marking*____

JOB PREPARATION

Description and Source of Card Files

MFCU: Primary Hopper — *Item cards*

Secondary Hopper —

Description of Disk Cartridges and/or Files

DISK: Removable 1 — *Inventory Master File - Pack No. I1*

Removable 2 —

Description of Form

PRINTER: Form Number — *∅136∅*

Form Name — *Order Acknowledgement*

JOB COMPLETION

Destination of Card Files

MFCU: Stacker 1 — *Item cards - Hold for Run # 3*

Stacker 2 —

Stacker 3 —

Stacker 4 —

Disposition of Cartridges

DISK: Removable 1 — *Hold for Run # 3*

Removable 2 —

Distribution of Forms

PRINTER: Burst? ✔

Decollate? ✔

*Original and 1 copy to Dept. ∅1,
2 copies to warehouse*

RPG PROGRAMMED HALTS

Halt Code	Halt Meaning	Action Required
H1		
H2		
H3		
H4		
H5		
H6		
H7		
H8		
H9		

SPECIAL INSTRUCTIONS

1. Print 4 copies

2. Print 6 lines to the inch.

3. Key OCL statements listed at the back page.

Figure 22-0: Program Run Sheet (Front)

| Application | Order Writing | | | | Date | 7-6-70 |
| Program Name | ORDER 1 | | Number | ΦΦ1 | Programmer | A. Marking |

OCL STATEMENTS

```
/£
// CALL ORWR,F1
// RUN
```

Figure 22-0: Program Run Sheet (Back)

Program identifications. This section tells the operator
the name of the application for which the program was
prepared. It also specifies the name of the program,
the number assigned to the program, and the name of
the programmer who prepared the program. The
programmer's name is entered so that the operator
can return the program to him for corrections in the
event of program malfunction.

IBM SYSTEM/3 DISK SYSTEM
PROGRAM RUN SHEET

Application ___Order Writing___ Date ___7-6-70___

Program Name ___ORDER 1___ Number ___ØØ1___ Programmer ___A. Marking___

Figure 22-1: Section of the Program Run Sheet showing program identifications.

Job preparation instructions. This section identifies the
card decks to use and the order in which the decks are
to be placed in the MFCU hoppers. (i.e., program deck
followed by data cards). It also specifies which disk
cartridge(s) to mount on the disk drive(s) and the
forms to load on the printer. No entry means that
the use of the device is not required.

JOB PREPARATION

Description and Source of Card Files

MFCU: Primary Hopper ___Item cards___
Secondary Hopper

Description of Disk Cartridges and/or Files

DISK: Removable 1 ___Inventory Master File - Pack No. I1___
Removable 2

Description of Form

PRINTER: Form Number ___Ø136Ø___
Form Name ___Order Acknowledgement___

Figure 22-2: Section of the Program Run Sheet giving job preparation instructions.

Job completion instructions. This section specifies:

1. Into which stacker the cards will fall and what to do with them.
2. What to do with the disk cartridge(s) after the run has been made.
3. Whether or not to *burst* (to cut the form along the perforation) and to *decollate* (to remove the carbon in between the forms), and where the printed copies are to be distributed.

JOB COMPLETION

Destination of Card Files

MFCU: Stacker 1   *Item cards - Hold for Run #3*
      Stacker 2
      Stacker 3
      Stacker 4

Disposition of Cartridges

DISK: Removable 1   *Hold for Run #3*
       Removable 2

Distribution of Forms

PRINTER: Burst?_✔_   *Original and 1 copy to Dept. Ø1,*
          Decollate?_✔_   *2 copies to warehouse*

Figure 22-3: Section of the Program Run Sheet giving job completion instructions.

Programmed halts and restart instructions. This section is subdivided into three columns. The first column lists the nine possible programmed halt codes which may be displayed on the Display Unit of the System Control Panel. The second column interprets the meaning of the code displayed, and the last column specifies the action(s) required of the operator to recover from the halt. One or more entries may be listed in this section. For every halt that the programmer anticipates, an interpretation is provided and the required operator action is specified.

RPG PROGRAMMED HALTS

Halt Code	Halt Meaning	Action Required
H 1		
H 2		
H 3		
H 4		
H 5		
H 6		
H 7		
H 8		
H 9		

Figure 22-4: Section of the Program Run Sheet giving instructions relative to Programmed Halts.

Special instructions. Any other instructions which the programmer wishes to give to the operator are specified in this section, i.e. print 6 lines per inch, print 3 copies, etc. If the programmer wants the OCL statements entered into the system through the printer-keyboard, he will specify it here. If he does not make that specification, the operator can assume that the OCL statements are included in the program deck handed to him by the programmer.

SPECIAL INSTRUCTIONS

1. Print 4 copies
2. Print 6 lines to the inch.
3. Key OCL statements listed at the back page.

Form No. GX21-9122-0
Printed In USA

Figure 22-5: Section of the Program Run Sheet containing special instructions.

Required OCL statements. This section lists those OCL statements which are to be inlcuded with the program to be run on the system. The operator checks the OCL cards against the list of OCL statements appearing in this section. Each statement listed in this section must have a corresponding OCL card and must be arranged in the same order as listed. The list also enables the operator to repunch damaged OCL statement card. Columns 1-96 in this section correspond to the columns in the 96-column card. If an OCL statement needs to be repunched, it should be punched in the same columns in which they are shown in this section. The same restriction applies when entering OCL statements through the printer-keyboard. Each statement must be keyed in the same columns in which they are shown in this section and on a line for line basis.

Figure 22-6: Section of the Program Run Sheet specifying the required OCL statements.

SUMMARY

We can now summarize the various tasks of the operator
and the sequence in which he will perform them in
his installation.

At the beginning of the day, the operator receives the
Job Schedule Sheet. This sheet outlines the operator's
(and system's) work for the day in the sequence that the
various jobs are to be run.

When the operator is ready to run the first job, he
is given the program deck and the corresponding
Program Run Sheet. The Program Run Sheet tells him
what he must know to proceed with the processing
operation. He then gets the necessary input data and
begins processing.

When the job is completed, the operator refers again
to the Program Run Sheet to determine what to do with
the input cards used, the output cards produced (if any),
the disk cartridge(s) used, and the printed output.
Depending upon instructions on the Program Run Sheet,
the operator may return all input cards in their original
places (in files), or set aside some of the cards for use
in following runs. He may do the same with the disk
cartridges. After he distributes the printed outputs, he
initials the Job Schedule Sheet to indicate completion of
the first job. This sequence of activities is then repeated
for each succeeding job to be run during the day.

Please answer the following questions for Section 3 so that you can determine whether you understand the major concepts covered in that section. If you have difficulty answering any questions, go back and reread the text until you find the correct answer. When you have answered all the questions, compare your answers with those provided on the following answer sheet.

1. Listed below are various tasks performed by an operator. Match the task with the associated device.

   1) Data Entry Keyboard _____
   2) Processing Unit _____
   3) Card Sorter _____
   4) MFCU _____
   5) Printer _____
   6) Printer-Keyboard _____
   7) Disk Unit _____

   a. Loading and aligning forms
   b. Sorting cards
   c. Punching and verifying cards
   d. Changing print chain
   e. Identifying programmed halts
   f. Mounting disk cartridge
   g. Entering data directly into the system

2. Match the items below with the related document.

   1) Tells operator which job to run first or next _____
   2) Contained in the Run Book _____
   3) Tells operator the type of form to load on printer _____
   4) Tells equipment scheduled for maintenance _____
   5) Contains list of programmed halts _____
   6) Operator initials after completion of a job _____

   a. Job Schedule Sheet

   b. Program Run Sheet

1. Listed below are various tasks performed by an
   operator. Match the task with the associated device.

   1) Data Entry Keyboard _c_   a. Loading and aligning forms
   2) Processing Unit _e_   b. Sorting cards
   3) Card Sorter _b_   c. Punching and verifying cards
   4) MFCU _b_   d. Changing print chain
   5) Printer _a, d_   e. Identifying programmed halts
   6) Printer-Keyboard _g_   f. Mounting disk cartridge
   7) Disk Unit _f_   g. Entering data directly into the system

2. Match the items below with the related document.

   1) Tells operator which job to run first or next _a_   a. Job Schedule Sheet
   2) Contained in the Run Book _b_
   3) Tells operator the type of form to load on   b. Program Run Sheet
      printer _b_
   4) Tells equipment scheduled for maintenance _a_
   5) Contains list of programmed halts _b_
   6) Operator initials after completion of a job _a_

Of all the programs that the operator is required to run, the program to print a sales report is one of the simplest in its requirements. We will use this program as a vehicle to explain many of the basic tasks required of an operator. In this section, we will explain the purpose of the program and provide you with a detailed description of the procedures involved in operating the System/3 computer throughout all phases of the program.

From here on, you will be given reading assignments in the *IBM System/3 Disk System Operator's Guide (GC21-7508)*. We will refer to it simply as the *Operator's Guide*. When you are asked to read certain topics, do so before proceeding further in the text. Remember, you are not expected to memorize the materials presented here or in the *Operator's Guide*. Feel free to refer back to any of the materials when you feel the need to do so.

PROGRAM TO PRINT A SALES REPORT

The program is in punched card form and is designed to perform a simple printing operation. It requires very few calculations of the computer. Three decks of cards are required: the first containing the required set of OCL statements, the second containing the program, and the third containing the data.

The OCL statements in this run supply the current date and tell whether the program will be loaded from cards or from disk. The program deck contains instructions that tell the computer how to process the data contained in the data deck. It tells the computer to compute various totals, and to print the Sales Commission Report (Figure 23) using the printer.

The report includes:

The commission amount equivalent to 10% of the invoice amount equal to or less than $10,000.00.

The commission amount equivalent to 12% of the invoice amount in excess of $10,000.00. (This amount is printed only if the invoice amount exceeds $10,000.00.)

Total commission amount for each salesman.

Invoice amount.

Invoice number.

Customer number.

Salesman number.

Final total. (This amount represents the sum of all commission amounts and is printed only on the last line of the report.)


```
                    SALES COMMISSION REPORT


SALESMAN    CUST.    INVOICE   AMOUNT    PERC    COMMISSION

2001        1000017  500018    12345678   10%    1,000.00

                                          12%   13,615.81

            1000018  500019    00065321   10%       65.32

                         SALESMAN TOTAL         14,680.13


SALESMAN    CUST.    INVOICE   AMOUNT    PERC    COMMISSION
2002        100019   500020    00825512   10%      825.51

                         SALESMAN TOTAL            825.51
                            FINAL TOTAL         17,353.52
```

Figure 23: The Sales Commission Report.

The data deck for this program is an Invoice Summary
File. Each card in the file contains information concerning
each sale made by individual salesmen. The information
included in each record is shown in Figure 24. Included are:

Invoice number
Date of sale
Customer number
Gross amount of sale
Discount allowed
Invoice amount
Salesman number

Figure 24: Format of the Invoice Summary Card.

Assume that you have been given the card decks just discussed. If this were a production run, you would also be given the Job Schedule Sheet and the Program Run Sheet for this job. See Figure 25 for a sample of how the Job Schedule Sheet would look.

SCHEDULE				
Date 6/2/70				
SEQUENCE	JOB NO.	JOB NAME OR DESCRIPTION	RETURN TO	OPERATOR INITIALS
1	23A	Sales Commission Report	A. Marking	
2	16C	Revise Catalog Price List	D. Shafer	
3	127	Billing List and Punch	J. Kelly	

Figure 25: Sample Job Schedule Sheet.

The Program Run Sheet (a page in the run book) for
this program has the following entries (see Figure 26a
and 26b).

Sales Analysis.   This tells the name of the application
for which the program was prepared.

SLSCOM.   This is the abbreviated name of the sales
commission report. It is the name assigned to
the program.

5.   This is the number assigned to the program.

A. Marking.   This entry identifies the author of the
program.

Object program followed by Invoice Summary File.
This is the order in which the card decks should be
loaded into the primary hopper of the MFCU.
(Note that the OCL cards are not entered in this
line. This is because the OCL cards for a particular
program should be the first to enter the MFCU if
the OCL statements are in punched card form.
The operator must always assure that this happens.)

Printer preparation. Gives instruction to use
plain stock.

Printer output instructions.   Instructs the operator
to burst and decollate forms, and to send one copy
to Mr. J. Kelly, Dept. 64, and J. Schwartz.

Special instructions. Instructs the operator to print
3 copies and print six lines to the inch.

OCL statements.   Tells the operator the OCL
statements (listed in their proper order) which
must be included in this run.

No entries were made on the disk portion of the
program run sheet because the program does not make
use of any other disk besides the one that houses the
resident system. There are also no entries on the
Programmed Halt section. This means that the
programmer does not anticipate any halt will occur
during the execution of this program.

Application *Sales Analysis*   Date *7-6-70*

Program Name *SLSCOM*   Number *5*   Programmer *A. Marking*

JOB PREPARATION

Description and Source of Card Files

MFCU: Primary Hopper | *Object program followed by Invoice Summary File* |
Secondary Hopper | |

Description of Disk Cartridges and/or Files

DISK: Removable 1 | |
Removable 2 | |

Description of Form

PRINTER: Form Number | |
Form Name | *Plain stock* |

JOB COMPLETION

Destination of Card Files

MFCU: Stacker 1 | *Object program, Invoice Summary File* |
Stacker 2 | |
Stacker 3 | |
Stacker 4 | |

Disposition of Cartridges

DISK: Removable 1 | |
Removable 2 | |

Distribution of Forms

PRINTER: Burst? ✔ | *1 copy each to Mr. J. Kelly, Dept. 64,* |
Decollate? ✔ | *and Mr. J. Schwartz* |

RPG PROGRAMMED HALTS

Halt Code	Halt Meaning	Action Required
H1		
H2		
H3		
H4		
H5		
H6		
H7		
H8		
H9		

SPECIAL INSTRUCTIONS

1. Print 3 copies

2. Print 6 lines per inch.

Figure 26a: (Front) The Program Run Sheet.

Application	Sales Analysis				Date	7-6-70
Program Name	SLSCOM		Number	5	Programmer	A. Marking

OCL STATEMENTS

```
/&
// DATE 070670
// LOAD *
// RUN
```

Figure 26b: (Back) The Program Run Sheet

DESCRIPTION OF PROCEDURES

Several procedures are involved in operating the System/3 through all the phases of this program. These procedures are:

Readying the MFCU with the OCL, program, and data decks.
Readying the printer with plain stock forms.
Readying the disk unit.
Initiating program execution.

The above procedures will be discussed in the order of actual processing operation, in order to define what is being accomplished by the procedure and to give further information about the particular device being addressed. Following this the steps which the procedure entails are enumerated. You will be told when to begin performing the steps involved in each procedure.

INTRODUCTION TO READYING THE MFCU

To get the MFCU in ready status, some preparatory steps are required. Procedure 1 lists the steps. The Program Run Sheet contains the instruction as to the order in which the card decks are to be loaded into the MFCU.

To perform the steps in Procedure 1 you must work with the MFCU. Figure 27 shows a detailed view of the MFCU *file-feed* and hoppers.

The card deck which you place in the MFCU hopper can be of considerable height without the deck toppling, owing to the tilt of the file-feed. Cards in the hopper will be drawn evenly into the reader. The last card will pass through it if the *card weight* is on top of the deck. The card weight exerts a slight pressure so that the card makes firm contact with the feed mechanism.

At the top right-hand corner of Figure 27 you see the panel of keys and indicators. These enable you to communicate with the device. For a complete explanation of the use and significance of the keys and indicators, read the section entitled "MFCU Controls and Indicators" in Chapter 3 of the *Operator's Guide*. When finished, return to this text.

Procedure 1: READYING THE MFCU FOR OPERATION

Read Steps 1 through 5 below and, upon completion, take the card decks labeled OCL # 1, SLSCOM # 5, and INVOICE SUMMARY from your box of cards, go to the MFCU, and perform Steps 1 through 5. Then repeat
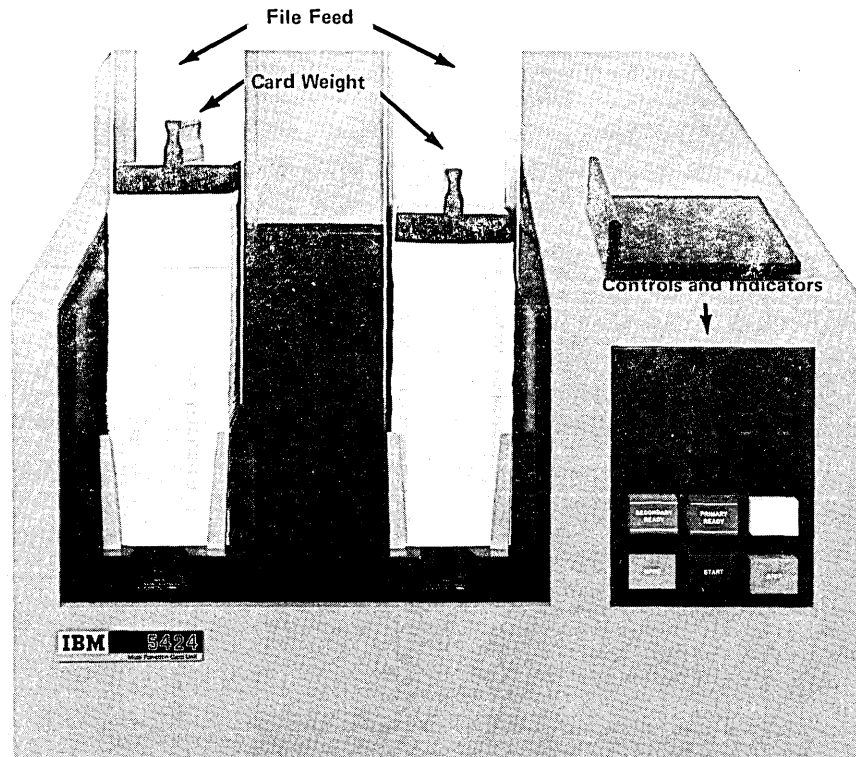
Figure 27: IBM 5424 Multi-Function Card Unit (MFCU).

Steps 1 and 2 to clear the MFCU, and set the cards aside; you will use them again later.

1. Remove any cards from both hoppers.
2. Depress the NPRO (Non-Process Run Out) key twice. This action clears cards remaining in both feeds.
3. Place the required card decks in the MFCU primary hopper (face down top edge to the left) according to instructions in the Program Run Sheet.
4. Place the card weight on top of the deck.
5. Depress the START key. This action brings the MFCU in ready status. The PRIMARY READY indicator will light up to indicate that the primary feed path is ready for operation.

You have now readied the MFCU. To clear the MFCU repeat Steps 1 and 2.

6. Remove the cards from the stacker and place them in front of the card deck which you removed from the hopper. This action places the card decks in their original order.

INTRODUCTION TO READYING THE PRINTER

As the Program Run Sheet specifies, the output device used in this job is the printer. Procedure 2 prepares the printer for operation.

The printer may use various forms. Although this job requires that you use plain stock forms, other jobs may require that you use preprinted forms such as the one shown in Figure 28.

Some jobs may require only single copies, others may require as many as five copies. Nevertheless all printer forms have two features in common - - they are continuous (made of one long piece of paper with pages separated by perforation), and they have side margins punched with feed sprocket holes. See Figure 28.

Four operations are involved in readying the printer. All are included in Procedure 2 and are outlined in the order that they should be performed. If you remember the purpose of each operation, the detail will become obvious to you, and you will find it easy to recall the operations after one practice session. They are:

1. Loading the paper forms. Obviously, the printer must have forms on which to print.
2. Aligning the forms. This involves vertical and lateral adjustments of the form to assure that the characters printed are not only on the proper line but also on the proper space provided for them. This is especially necessary on preprinted forms where the characters printed must be in the exact locations allocated for them.
3. Setting up the paper form stacker. This operation insures that the forms printed stack properly on the paper form stacker.
4. Final readying of the printer. This operation turns on the READY light on the Printer Operator's Panel to indicate that the printer is ready for operation.

These steps appear long and complicated. In actual practice they are all completed in a very short time.

Figure 28: Sample Preprinted Form.

To perform the steps in Procedure 2 you need to be familiar with the various controls and indicators on the printer. For an explanation of the controls and indicators, read the section entitled "Printer Controls and Indicators" in Chapter 4 of the *Operator's Guide*. Do not proceed with this text until you have read the above section.

PROCEDURE 2: READYING THE PRINTER

As previously mentioned, four operations are involved in readying the printer. These operations are described in 23 steps in the *Operator's Guide*. Read "Loading Forms in the Printer" in Chapter 4 of the *Operator's Guide*, and go to the printer and perform each step. After you have executed all 23 steps, you will have readied the printer. Repeat Steps 1 through 3 to remove the forms from the printer. After you have performed all 23 steps for readying the printer and have removed the forms from the printer, continue with this text.

INTRODUCTION TO READYING THE DISK UNIT

In a System/3 disk system installation it is a common practice to have disk cartridge(s) mounted on the drive(s) even if the system is not in use. This is done to keep dust from entering the disk unit. Because of this practice, the operator must almost always perform three tasks to ready the disk unit for a job, namely:

1. Dismount the disk cartridge currently on the drive (unless that cartridge is the one required for the job);
2. Mount the disk cartridge specified on the Program Run Sheet; and
3. Use the keys and switches on the Disk Panel to get the disk unit in ready status.

The steps involved in these tasks are presented in Procedure 3a and 3b. Procedure 3a enumerates the steps for dismounting a disk cartridge from the drive, and Procedure 3b enumerates the steps for both mounting a disk cartridge and getting the disk unit in ready status.

While most jobs that are run on the disk system require the operator to perform Procedures 3a and 3b, some may not. In our sample problem (program to print a Sales Commission Report), no other disk is required beside the one which houses the resident system. If the resident system is housed on F1, then only the keys and switches on the Disk Panel are needed to ready the disk unit. If the resident system is on a removable disk, then Procedures 3a and 3b will have to be performed to ready the disk unit. In the next topic you will be asked to perform Procedures 3a and 3b to gain experience in operating the disk unit.

To become more familiar with the Disk Panel, the disk cartridge, and the disk drawer, read the section "Disk Panel" in Chapter 2, and sections "Description of the Disk Cartridge" and "Description of the Disk Drawer" in Chapter 5 of the *Operator's Guide*. Continue with this text after you have completed the reading.

NOTE: Do not concern yourself with the IPL Selector on the Disk Panel. It will be covered later in this Study Guide.

PROCEDURE 3a: DISMOUNTING A DISK CARTRIDGE

The steps in this procedure are listed in the *Operator's Guide*. Read "Dismounting a Disk Cartridge" in Chapter 5 of the *Operator's Guide*. Inform your advisor when you have completed the reading. Then go to the disk unit and perform the steps for dismounting a disk cartridge. Continue with this text after you have dismounted the disk cartridge.

PROCEDURE 3b: MOUNTING A DISK CARTRIDGE

The steps involved in mounting a disk cartridge are found in the *Operator's Guide*. Read the section entitled "Mounting a Disk Cartridge" in Chapter 5 of the *Operator's Guide*. When you have completed the reading, inform your advisor. He will tell you where the resident system for your System/3 is housed. If the resident system is not housed on the fixed disk (F1), he will give you the disk which does. Take that to the disk unit and perform the steps for mounting a disk cartridge. If the resident system is housed on F1, ask your advisor for a disk cartridge which you can use. Take that to the disk unit and perform the steps for mounting a disk cartridge. When you have performed all of the steps listed under "Mounting a Disk Cartridge" you will have readied the disk unit. Set the START/STOP switch to STOP before leaving the disk unit. After you have completed the above instructions, continue with this text.

INTRODUCTION TO INITIATING PROGRAM EXECUTION

In preparation for running a program that will produce a printed Sales Commission Report, you have thus far performed the actual procedures required to ready the MFCU, the printer, and the disk unit. Actual processing, however, has not yet been initiated. This is discussed in Procedure 4, Initiating Program Execution, and is dependent upon the status of the MFCU, the printer, and the disk unit - - all these devices must be in ready status before program execution can be initiated. Since you readied and later unreadied the MFCU, the printer, and

the disk unit, you will have to ready all these devices again before the program can be read and the processing unit can begin program execution.

Besides readying the MFCU, printer, and disk unit, you will also use controls and indicators on the Processing Unit to initiate program execution. The information on controls and indicators is covered in two sections - - "System Controls and Indicators" and "System Control Panel" in Chapter 2 of the *Operator's Guide.* Read those two sections, then continue with this text.

PROCEDURE 4: INITIATING PROGRAM EXECUTION

Six short steps are entailed in initiating program execution. Read Steps 1 through 6 and, upon completion, perform each step. Some of the steps refer to steps in Procedures 1, 2, and 3. Feel free to refer back to any of those procedures when you feel the need to do so.

As you read Step 2, you will encounter the words "/*" card. This card should be the card immediately behind the last data card. It has a /* in columns 1 and 2; the rest of the columns are blank. This card tells the computer that no other cards follow for this job.

After you have performed the procedure and the run has been completed, clear the MFCU, remove the forms from the printer, and set the START/STOP switch on the

Disk Panel to STOP. Separate the cards (OCL# 1, SLSCOM#5, and INVOICE SUMMARY) which you removed from Stacker 1, place rubber bands around each set of cards, and return them in your box of cards. You may keep the report. Continue reading the next section after you have completed the following instructions:

1. Clear the MFCU.
2. Place the card decks labeled OCL# 1, SLSCOM # 5 and INVOICE SUMMARY in the primary hopper in the order specified on the Program Run Sheet. Load the cards face down, top edge to the left. Make sure a /* card is placed behind the last data card.
3. Depress MFCU START. The PRIMARY READY indicator will light up to indicate that the primary path is ready for operation.
4. Ready the printer.
5. Ready the disk unit. If the resident system is not on F1 when you ready the disk unit, be sure you mount the disk cartridge which houses the resident system.
6. Depress console START. The program will be executed, the output will be printed, and the system will halt with an "EJ" in the Message Display Unit to indicate the end of the job.

As long as it is necessary for people to direct the computer to produce output, errors will be committed. For instance, the programmer may overlook instructions, thus producing erroneous results. Or the operator may make mistakes while operating the system and cause erroneous results. Designers have taken into consideration these possibilities for error and have made provisions for them in the development of computers. Today, computers can recognize errors in the program and, to a certain degree, errors in the operation of the system.

This section describes the ways the System/3 informs the operator when an error has occurred or when a device needs operator attention. It also presents procedures for recovering from an error and actions to take when a device needs operator attention.

CLEARING THE I/O ATTENTION LIGHT

Read "Clearing the I/O Attention" in Chapter 10 of the *Operator's Guide*. Be sure you can answer the review questions below before reading further in this text.

1. When the I/O attention light turns on, the operator must look at the control panel of the following device (s): _____

   a. Printer
   b. Data Recorder
   c. MFCU
   d. Sorter
   e. Disk Unit
   f. Printer-Keyboard

2. The actions listed below take place as a result of a stacker full condition on the MFCU. Number these in the order that they should take place.

   ____ Press the START key on the MFCU.
   ____ Remove cards from the MFCU stacker and place them on the bin directly above that stacker.
   ____ I/O attention light on the System Control Panel and the STKR light on the MFCU Panel goes on.
   ____ I/O attention light goes off

Answers to the review questions:

1. When the I/O attention light turns on, the operator must look at the control panel of the following devices: _a, c, e_

   a. Printer
   b. Data Recorder
   c. MFCU
   d. Sorter
   e. Disk Unit
   f. Printer-Keyboard

2. The actions listed below take place as a result of a stacker full condition on the MFCU. Number these in the order that they should take place.

   _3_ Press the START key on the MFCU
   _2_ Remove cards from the MFCU stacker and place them on the bin directly above that stacker.
   _1_ I/O attention light on the System Control Panel and the STKR light on the MFCU Panel goes on.
   _4_ I/O attention light goes off.

RECOVERING FROM PROGRAM HALTS

The system may halt during a run as a result of incorrect program operation, machine errors, or in some cases, incorrect information or instructions. When a halt occurs, the System/3 displays a two position halt code on the Display Unit in the System Control Panel, and prints the error code on the logging device (printer or printer-keyboard). These codes are used by the operator to determine which corrective actions to take. The corrective actions are called *Recovery Procedures*.

The *IBM System/3 Disk System Halt Procedure Guide (GC21-7540)* explains how the halt and error codes are used by the operator to determine which corrective actions to take, and lists all identifiable halts along with their corresponding recovery procedures.

The usual procedure followed by the operator when the system halts is to:

1. Look at the halt code displayed on the Display Unit and the error code logged or printed on the logging device;
2. Find the corresponding codes in the *System/3 Disk System Halt Procedure Guide;* then
3. Perform the appropriate recovery procedure.

If the system halts and a code which does not correspond to any of the codes listed in the *System/3 Disk System Halt Procedure Guide* is displayed, notify the supervisor responsible for your installation. He will know the actions to take under this situation.

For more information on how to use the codes in order to perform the appropriate recovery procedures, read the first five short topics on the *IBM System/3 Disk System Halt Procedure Guide.* Scan the remaining pages to be familiar with the manual. Continue with this text after you have completed the reading.

TERMINATING THE JOB BEFORE IT IS COMPLETED

Normally, the operator runs a job on the computer and continues on until the job is completed. There are instances, however, when the operator may have to terminate or stop a particular job before completion. There are several reasons for this. One of them is that the operator may have discovered too late that he used the wrong data cards, or wrong forms were used for the run. Another reason may be that the program being run is producing results different from what he expected. Errors such as these may not be recognized by the system and therefore, it becomes necessary for the operator to intervene and terminate the job.

The section "Stopping a Job Before It Is Completed," found in Chapter 10 of the *Operator's Guide,* explains the steps that the operator must follow when it becomes necessary to terminate a job. Read that section. Proceed with this text after you have read the section.

Please answer the following questions for Section 5, so
that you can determine whether you understand the major
concepts covered in that section. If you have any difficulty
answering any questions, go back and reread the text
until you find the correct answer. When you have answered
all the questions, compare your answers with those provided
on the following answer sheet.

1. Which section in the *Operator's Guide* lists the
   procedure for terminating a job prior to its completion?

   _____

2. Which manual contains the procedures for recovering
   from a program halt?

   _____

3. Go to the manual stated in your answer to Question 2
   and match the following halt and error codes with the
   associated reason.

Halt Codes Displayed	Error Codes Logged	Reason
____ OA	IDOA	a. Wrong pack mounted
____ 1P	R1P	b. No program name given
____ 30	UC30SP	c. A disk operation was called for but the referenced unit is not ready.
____ 81	CR81ON	d. Forms in printer need positioning.
____ 38	UF38WP	e. Space not available on F1. Delete unnecessary files.

1. Which section in the *Operator's Guide* lists the procedure for terminating a job prior to its completion?

   Chapter 10- "Stopping a Job Before It Is Completed"

2. Which manual contains the procedures for recovering from a program halt?

   IBM System/3 Disk System Halt Procedure Guide (GC21-7540)

3. Go to the manual stated in your answer to Question 2 and match the following halt and error codes with the associated reason.

Halt Codes Displayed	Error Codes Logged	Reason
_c_ OA	IDOA	a. Wrong pack mounted.
_d_ 1P	R1P	b. No program name given.
_e_ 30	UC30SP	c. A disk operation was called for but the referenced unit is not ready.
_b_ 81	CR81ON	d. Forms in printer need positioning.
_a_ 38	UF38WP	e. Space not available on F1. Delete unnecessary files.

Thus far you have used the System/3 computer to run a program which produced a sales commission report. In running that program, you have performed all the necessary procedures, from readying the various devices required by the program to initiating program execution. You have also learned how to recover the system, should it halt during a program run. But before you could run the sales commission program, it was necessary for the advisor to perform some preparatory tasks on the system, as well as on the program. These tasks are:

1. System preparation
2. RPG II program compilation

Both are operator responsibilities. In the following pages you will read introductory information about each of the tasks and you will be asked to perform exercises which will give you experience in operating the system to accomplish these tasks.

INTRODUCTION TO SYSTEM PREPARATION

Before the first job for the day can be run on the system, or whenever the system is turned on preparatory to a program run, the operator must prepare the system for operation. To prepare the system, he must run an IBM program called *Initial Program Loader (IPL)*. The IPL program is one of the programs that make up your resident system. It is loaded into the system by using the IPL Selector switch on the Disk Panel and the PROGRAM LOAD key on the System Console. The IPL run is referred to as the *initial program loading*. The IPL program clears core storage (sets core storage to zero) and performs functions that enable the system to become operational for any job. The *Operator's Guide* presents a thorough discussion on preparing the system for operation. Read "Preparing for System Operation" in Chapter 7 of the *Operator's Guide*. After you have completed the reading, continue with this text.

PROCEDURE 5: SYSTEM PREPARATION

Initial program loading is usually performed in conjunction with the running of the first job. You will be asked to do an exercise that requires you to perform initial program loading and to supply the DATE statement only. The intent of this exercise is to give you experience in preparing the system for operation. Follow the instructions below to perform initial program loading.

1. Get the card labeled DATE STATEMENT from your box of cards.
2. Ready the MFCU with the DATE STATEMENT card.
3. Perform step a and b below if the disk cartridge which contains the resident system is to be mounted and b (only) if the proper cartridge is already mounted or if the resident system is on fixed disk (F1).
   a. Mount the disk cartridge which contains the resident system on R1.
   b. Set the File 1 START/STOP switch on the Disk Panel to START.
4. Set the IPL SELECTOR switch to FIXED if the resident system is on F1, or to REMOVABLE if the resident system is on R1.
5. When the File 1 READY light on the Disk Panel is lit, depress PROGRAM LOAD on the System console. The IPL program will be loaded and execution will begin. When IPL is completed, the DATE statement card will be read and the system will halt with the I/O attention light on the System Console lit. The I/O attention light comes on whenever the system attempts to read cards and does not find any on the MFCU. Notify your advisor at this point and continue reading this text.

INTRODUCTION TO RPG II PROGRAM COMPILATION

Presenting instructions to the computer is like writing a letter in English to a person who speaks another language. The letter has to be translated into the receiver's native language before he can understand it. In preparing instructions for the System/3, the programmer uses a language called *RPG II*. This language is different from the language used by the system, known as *machine language*. Before the system can execute the programmer's instructions, his instructions must first be translated into machine language. The RPG II Compiler Program performs the translation; it produces instructions in machine language form. The RPG II Compiler is loaded into the system from the resident system.

In the System/3 Disk System, instructions in machine language form can be stored either on disk or on cards. Where they are stored is decided by the programmer. The programmer tells the system where he wants the machine language instructions stored through his program, and he tells the operator through the Program Run Sheet. The instructions prepared by the programmer are called the

source program, and the machine language instructions which are the output of RPG II compilation are called the *object program*.

More information on the RPG II program is contained in the section entitled "RPG II Program" in Chapter 8 of the *Operator's Guide.* Read the section. As you do, you will encounter these steps:

1. Figure 21 showing the various decks of cards and how these cards should be loaded into the MFCU hopper preparatory to program compilation. As far as you are concerned, you only need to know which deck is the source program. It is the programmer's job to include any card decks which he wants compiled with his program. The Program Run Sheet for that program will provide you instructions you need to compile that program.

2. Clearing the MFCU after a *diagnostic only run.* Generally, during program compilation, the object program is being punched in cards or stored on disk at the same time that translation is going on. However, in a diagnostic only run the object program is not stored. The objective of a diagnostic only run is to produce a printed output which the programmer will use to find errors in his program.

3. Object Program Execution. The steps listed under Object Program Execution do not refer to any specific program. With the appropriate Program Run Sheet, those steps can be used to execute any object program on the System/3 Disk System.

After you have read the section entitled "RPG II Program", you will be asked to perform two exercises. The first exercise, Procedure 6, requires that you compile the source program for the Sales Commission Report (found in your box of cards). The output of that compile run is a printed listing of the source program and an object program stored on disk. The second exercise, Procedure 7, requires that you execute the object program (which was stored on disk in Procedure 6) using the same data cards used in Section 4. The output of this exercise is a printed Sales Commission Report exactly like the one produced in Section 4.

Read the section entitled "RPG II Program," in Chapter 11 of the *Operator's Guide* and return to this text when you have completed reading them.

PROCEDURE 6: RPG II PROGRAM COMPILATION

In Chapter 11 of the *Operator's Guide,* you read about the procedure for RPG II program compilation. Now, get the decks of cards labeled SOURCE SLSCOM and OCL#2 from your box of cards. Follow the procedure for RPG II program compilation in the *Operator's Guide,* and compile

the SOURCE SLSCOM. Be sure to place a /* card behind the last source program (SOURCE SLSCOM) card. Remember, the object program produced in this run is not punched in cards but stored on disk.

When you have completed the run (completion is indicated by an EJ displayed on the Display Unit), perform the instructions below. Return to this text when you have completed.

1. Perform the procedure for "Clearing the MFCU After a Successful Compilation", also found in Chapter 11 of the *Operator's Guide.*
2. Place rubber bands around the group of OCL statements (labeled OCL#2) and the source program (labeled SOURCE SLSCOM) which you removed from Stacker 1. Put them back in your box of cards.
3. Remove the printed output from the printer. It is not necessary to save the printed output.
4. Set the START/STOP switch on the Disk Panel to STOP.

PROCEDURE 7: OBJECT PROGRAM EXECUTION

You have just compiled the SOURCE SLSCOM program and stored the object program on disk. In the following exercise, you are going to load that program and execute it. Now, take the decks of cards labeled INVOICE SUMMARY and OCL#3 from your box of cards, follow the procedure for executing an object program in Chapter 11 of the *Operator's Guide,* and execute the program. Refer to the Program Run Sheet shown in Figure 29 for additional instructions. Make sure you placed a /* card behind the last data (INVOICE SUMMARY) card.

When you have completed the run (completion is indicated by an EJ displayed on the Display Unit), perform the instructions below. Return to this text when you have completed them.

1. Clear the MFCU.
2. Place rubber bands around the group of OCL statements (labeled OCL #3) and the data cards (labeled INVOICE SUMMARY) which you removed from Stacker 1. Place them back in your box of cards.
3. Remove the printed Sales Commission Report from the printer. It is not necessary to save the report.
4. Set the START/STOP switch on the Disk Panel to STOP.

IBM SYSTEM/3 DISK SYSTEM
PROGRAM RUN SHEET

Application **Sales Analysis**   Date **7-6-70**

Program Name **SLSCOM**   Number **5**   Programmer **A. Marking**

JOB PREPARATION

Description and Source of Card Files

MFCU: Primary Hopper   **Invoice Summary File**
Secondary Hopper

Description of Disk Cartridges and/or Files

DISK: Removable 1
Removable 2

Description of Form

PRINTER: Form Number
Form Name   **Plain stock**

JOB COMPLETION

Destination of Card Files

MFCU: Stacker 1   **Invoice Summary File**
Stacker 2
Stacker 3
Stacker 4

Disposition of Cartridges

DISK: Removable 1
Removable 2

Distribution of Forms

PRINTER: Burst? ____
Decollate? __

RPG PROGRAMMED HALTS

Halt Code	Halt Meaning	Action Required
H1		
H2		
H3		
H4		
H5		
H6		
H7		
H8		
H9		

SPECIAL INSTRUCTIONS

After completing the run, separate the OCL cards and Invoice Summary File cards, and place them back in your box of cards

---

Figure 29:   Program Run Sheet (Front)

Application	Sales Analysis			Date	7-6-70
Program Name	SLSCOM	Number	5	Programmer	A. Marking

OCL STATEMENTS

```
/&
// LOAD SLSCOM,R1
// RUN
```

Figure 29:   Program Run Sheet (Back)

ADDITIONAL INFORMATION

In the preceding exercises, you have performed specific
operating procedures for running the sales commission
program on the System/3 Disk System through all of its
phases. That is, you have compiled the sales commission
source program, produced the object program, and
executed that object program to output the Sales
Commission Report. In addition, you have learned
and have performed the procedures for loading and
executing an object program from cards (Procedure 4) and
from disk (Procedure 7). You will soon discover, however,
that the main differences in running programs on the
System/3 Disk System is the positioning of cards in the
MFCU, and the positioning of the IPL SELECTOR
switch on the System Console. (The position of the IPL
SELECTOR switch tells where the resident system is
located.) Except for those differences everything else
is very similar.

Section 7: System Control Programs and Program Products

The programs which IBM makes available to the users of the System/3 Disk System fall into two main categories, namely: *system control programs* and *program products*.

In general, the system control programs provide functions which are fundamental to the operation and maintenance of the system. They are the programs that make the disk system work. They include:

1. Disk System Management Programs
2. Disk System Maintenance Program
3. Disk Utility Programs
4. Disk Copy/Dump Programs

Program products, besides extending the capability of the system, enable the user to extend his efficiency in the use of the system. The program products include:

1. Disk RPG II Compiler Program
2. Basic Assembler Program
3. Disk Sort Program
4. Disk Resident Card Utility Programs

When a user receives his System/3 Disk System, he also receives with it a Distribution Disk Cartridge. This disk cartridge contains both the system control programs and the program products, and includes a program called the *system generation program*. This program is used during the run called System Generation. It allows the user to build or generate his resident system from the Distribution Disk Cartridge. In this way, he is able to tailor the resident system to his specific needs. As a result, his resident system will include, in addition to all system control programs, only those program products which his installation requires.

SYSTEM CONTROL PROGRAMS

The disk system management program controls the loading and running of disk system programs. The program facilitates compilation, generation, and execution of programs. Through Operation Control Language (OCL) statements the programmer tells disk system management which programs to run. Disk system management's functions are initiated by use of the PROGRAM LOAD key on the System Control Panel preparatory to a program run (assuming the resident is on the disk unit and the disk unit has been readied).

The remaining system control programs are explained in the *Operator's Guide*. Read the introduction to the topics listed below, in the *Operator's Guide:*

1. Disk Utility Programs, Chapter 8
2. System Maintenance, Chapter 10

Scan the related operating procedures. Remember, you are not expected to memorize any of the operating procedures. You are, however, expected to locate and follow operating procedures for running any system control program in the Operator's Guide. Continue with this text after you have completed the reading assignment.

PROGRAM PRODUCTS

The following are the program products available for the System/3 Disk System:

1. Disk RPG II Compiler. This program translates the RPG II source program into machine language.
2. Basic Assembler Program. Basic Assembler is another programming language used to write source programs for the System/3 Disk System. Source programs written in this language are processed by the Basic Assembler Program to produce the equivalent machine language instructions.
3. Disk Sort Program. This program arranges any disk file in ascending or descending sequence.
4. Disk Resident Card Utility Programs. The Disk Resident Card Utility Programs are composed of five subprograms. They include:
   a. Sort/Collate Program. This is a general purpose utility program which is used with the IBM 5424 MFCU to:

   Sort - produce a sequenced card file
   Merge - combine two presequenced card files
   Match - check two presequenced card files for
          paired records
   Select - separate certain card types from a
          sequenced or unsequenced card file

   b. Reproduce and Interpret Program. This program
   Interprets card decks - prints at the top of the
          card the data that is
          punched in the card
   Reproduce card decks - duplicate an entire card
          or portion of it into
          another card
   Reproduce and interpret card decks - (a
          combination of the above)

c. List Program. This program lists data on the
96-column card on the printer. A count of the
number of cards is printed at the end of the
listing. If the programmer desires, the program
will print only a card count.

d. Data Recording Program. This program allows
the System/3 with the IBM 5475 Data Entry
Keyboard to be used for on-line data recording.
The IBM 5424 MFCU is used as the punching
and interpreting device and the Data Entry
Keyboard for entering data.

e. Data Verifying Program. This program allows
the System/3 to be used to verify the accuracy
of recorded data. The IBM 5424 MFCU is
used to read the card deck which is to be verified.
The IBM 5475 Data Entry Keyboard is required
for entering the data to be verified.

Any or all of the above program products may be
present on your resident system depending upon the
requirements of your installation. Their corresponding
operating procedures are presented in the *Operator's
Guide.* SCAN the following topics in Chapter 8 of
the *Operator's Guide:*

96-List Program
96-96 Reproduce/Interpret Program
MFCU Sort/Collate Program
Data Recording Program
Data Verifying Program

Continue with this text after you have completed
the above assignment.

The operations addressed in this section are incidental operations, as differentiated from operations such as readying the disk unit, the MFCU, the printer, etc., which are performed on a regular basis. The operations are performed on:

1. The MFCU. The operations performed on the MFCU are:
      Clearing Card Jams
      Changing the MFCU Print Ribbon
      Emptying the MFCU Chip Box
2. The Printer. The operations performed on the Printer are:
      Changing the Printer Ribbon
      Changing the Print Chain Cartridge
3. The Printer-Keyboard. The operations performed on the printer-keyboard are:
      Removing the Type Ball
      Replacing the Type Ball
      Removing the Fabric Ribbon Cartridge
      Installing the Fabric Ribbon Cartridge

Any of the operations above may be required of an operator before and/or during program execution. The *Operator's Guide* describes the indicators which will lead the operator to the appropriate recovery procedure, should any of the operations be required during program execution. The *Operator's Guide* also presents in outline form the procedures to follow when performing each of the operations. Read the topics indicated under the following chapters of the *Operator's Guide.*

1. Chapter 3

      Clearing a Card Jam
      Changing the MFCU Print Ribbon
      Emptying the MFCU Chip-Box

2. Chapter 4

      Changing the Printer Ribbon
      Changing the Print Chain Cartridge

3. Chapter 6

      Removing the Type Ball
      Replacing the Type Ball
      Removing the Fabric Ribbon Cartridge
      Installing the Fabric Ribbon Cartridge

Remember, you are not expected to memorize any of the procedures for the various operations mentioned in this section. When a need for any of the operations arises you can always refer to the *Operator's Guide* for the associated procedure. Continue with this text after you have completed the reading.

SUPPLEMENTARY INFORMATION

Another device which may be attached to the System/3 Disk System is the printer-keyboard. For a review of its functions and how it is used, read the sections entitled "Use of the Printer-Keyboard" found in Chapter 6 of the *Operator's Guide.* Continue with this text after you have completed the reading.

Section 9: Card Sorter Operation

Earlier in this text, you studied the process of sorting with the MFCU. Using the MFCU (with the Sort/Collate Program) to sort cards is called *on-line sorting*. Card sorting may also be accomplished by using the IBM 5486 Card Sorter. The 5486 card sorting operation is independent of the System/3, and is called *off-line sorting*.

Throughout the remainder of this section, you will be given reading assignments in the *IBM 5486 Card Sorter Operator's Guide (GA21-9078)*. Refer to this publication whenever you are given reading assignments in this section.

The standard 5486 Card Sorter performs two main functions. These functions are arranging cards in ascending numerical order and arranging cards in alphameric order. How card sorting is done is covered later in this section.

To be able to operate the card sorter, you must first be familiar with its features. A description of the card sorter is given under "Machine Description" in the section entitled *Sorting Operating Procedures*. Read that description. As you read, note the main features of the machine: hopper, number of pockets, card racks, and operator console. These are the features you will be working with when you operate the card sorter. Proceed with this text when you have completed the reading.

NUMERIC SORTING

Read the topic "Sorting Functions" up to and including "Numeric Sorting" in the section entitled *Sorting Operating Procedures*. Be sure you can answer the following questions before reading further in this text. When you have completed answering these questions, compare your answers with those provided in the Answers to Review Questions - Section 9 found later in this section.

1. Sorting is done _____ column(s) at a time.
2. When the information to be sorted is a field, with which column should the sort begin? _____
3. What switch is set to tell the card sorter to do a numeric sort? _____
4. During Phase 1, which cards are sorted? Where are the unsorted cards after Phase 1? _____
5. The Column Selector Knob is used to select _____ and _____ .

ALPHAMERIC SORTING

Alphameric sorting procedures are similar to those of numeric sorting. Alphameric means that the data may be alphabetic, numeric, or a mixture of both. When Alphameric sorting is complete, the cards are arranged with the alphabetic characters in sequence from A to Z, followed by numeric characters in sequence from 0

through 9. This sequence is illustrated in Figure 18 found in the next reading assignment. Read "Alphameric Sorting" under *Sorting Functions*. After you have completed the reading, continue with this text.

SPECIAL FEATURES

Special features increase the versatility or efficiency of the card sorter. There are several special features available for the IBM 5486 Card Sorter. One increases the efficiency in sorting alphabetic data; another facilitates a count of the cards sorted; and still another enables cards with a blank or numeric character in a specific column of the card to be separated from the rest of the card deck. The latter is done without destroying the original sequence of the cards in the deck. These special features are identified and explained under "Alphabetic Sorting (Alphabetic Sort Special Feature)" and "Sort Suppress and Digit Select (Special Features)" in the section entitled *Sorting Operating Procedures*, and under "Auxiliary Card Counter" in *APPENDIX C. SPECIAL FEATURE*. Read those topics. As you read "Sort Suppress and Digit Select," notice the difference between a digit select and combined sort suppress and digit select run. During a digit select run, the selected cards fall into the pocket for that digit. For example, if cards with a 2 in a specific column are to be separated from a deck of cards, the selected cards will fall into the 3/2 pocket. However, during a combined sort suppress and digit select run, the selected cards will always go into the 1/0 pocket. In both cases, the rest of the cards in the deck go into the reject pocket. Now read the above topics; then continue with this text after you have completed the reading.

COMPLEMENTARY CARD SORTER INFORMATION

For more information on the operation and upkeep of the card sorter, refer to the *Card Sorter Operator's Guide*. You will find the information on the proper way to handle cards and how to use the card gauge under "Other Sorting Considerations" in the section entitled *Sorting Operating Procedures*. Appendix A of the guide contains a description of keys, switches, indicators, and error restart procedures. SCAN those topics. Although you are not expected to operate the card sorter efficiently upon completion of this section, you should be able to operate the IBM 5486 Card Sorter with the help of the *Card Sorter Operator's Guide* as a reference. Continue with this text after you have completed the assignment.

Please answer the following questions for Section 9 so
that you can determine whether you understand the
major concepts covered in that section. If you have any
difficulty answering any question, go back and reread
the text until you find the correct answer. When you
have answered all of the questions, compare your answers
with those provided in the following answer sheet.

1. Three passes per column are required for alphameric
   sorting. What is the mode switch setting for each pass?

   a. pass 1 _____

   b. pass 2 _____

   c. pass 3 _____

2. After an alphameric Phase 2 sort, the cards which
   should be placed first into the hopper for the next
   pass are the cards removed from pocket _____.

   a. 1/0

   b. 9/8

3. How many passes are required for alphabetic sorting
   with the special feature?

   _____

4. How should the mode switch be set to sort
   alphabetic data with the special feature?

   _____

5. Which cards are separated from the rest of the deck
   in sort suppress pass? _____

   a. Cards that are unpunched in the specified column

   b. Cards with zero in the specified column

   c. Cards with the specific numeric character

6. If a count of the cards sorted is required, during
   which pass should the auxiliary card counter
   switch be on?

   _____

NUMERIC SORTING

1. Sorting is done __1__ column(s) at a time.
2. When the information to be sorted is a field, with which column should the sort begin? *rightmost*
3. What switch is set to tell the card sorter to do a numeric sort? *mode switch*
4. During Phase 1, which cards are sorted? Where are the unsorted cards after Phase 1? *even, reject pocket*
5. The Column Selector Knob is used to select *tier* and *column* .

ANSWERS TO REVIEW QUESTIONS FOR SECTION 9

1. Three passes per column are required for alphameric sorting. What is the mode switch setting for each pass?

   a. pass 1 *Numeric*
   b. pass 2 *Numeric*
   c. pass 3 *Zone*

2. After an alphameric Phase 2 sort, the cards which should be placed first into the hopper for the next pass are the cards removed from pocket *a* .

   a. 1/0
   b. 9/8

3. How many passes are required for alphabetic sorting with the special feature?

   2

4. How should the mode switch be set to sort alphabetic data with the special feature?

   ALPHA FEAT

5. Which cards are separated from the rest of the deck in sort suppress pass? *a*

   a. Cards that are unpunched in the specified column
   b. Cards with zero in the specified column
   c. Cards with the specific numeric character

6. If a count of the cards sorted is required, during which pass should be auxiliary card counter switch be on?

   During the first pass

S/3 OPERATION - DISK

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Your answers to the questions on this sheet will help us produce better manuals for
your use. If any of your answers require comments, or if you have additional
information you think would be helpful, please use the space provided. All comments
and suggestions become the property of IBM.

	YES	NO
1. Is the text easy to read?		
2. Is any of the information unclear?		
3. Is additional information needed?		
4. Is any of the information unnecessary?		
5. Did you read the Preface?		
6. Did you use the Table of Contents?		
7. Did you take the tests?		
8. How did you use the text:		

Self - Training _____

Other (Explain)_____

Have you had previous computer or programming training?_____

What is your present job? _____

What business is your company engaged in? _____

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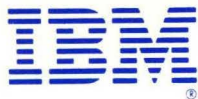Fold   Fold

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